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Two numbers of the Journal are published every year, one in July and one in December and contributions for publication should be sent to the Editor not later than the 1st of April and the 1st of September respectively.

Contributors are requested to be clear and concise. Manuscripts should not exceed 8,000 words and should be in a final form for the press. Each paper should start with a short summary which should be an abstract of the whole paper, complete and clear in itself, and not over 3 per cent. of the length of the paper. The introduction and reviews of literature should be restricted to closely pertinent papers.

The manuscript should be typewritten on one side of the paper only, with wide margins and be double spaced throughout including titles, footnotes, *literature citations* and legends. Symbols, formulae and equations must be written clearly and with great care. Scientific names of genera and species are printed in italics and should be underlined in the typescript. Too many tables, graphs, etc. should be avoided. Each table should be typed on a separate sheet with its proper position marked in the text in pencil.

Literature citations: All references to literature cited in the text should be presented together at the end of the paper in alphabetical order of authors' names. Each reference should be given in a standard form as follows: (1) name(s), followed by initial(s), of author(s); (2) year of publication in brackets; (3) full title of paper; (4) title of journal, abbreviated according to *World List of Scientific Periodicals*, 1934, and underlined; (5) volume number in Arabic numerals, underlined with two lines to indicate bold type; (6) page numbers without the prefix, p. When books are mentioned in the references, the order should be: name of author(s), initial(s), year in brackets, title of the book, which should be underlined, volume number, edition, page, followed by place of publication and name of publisher. Where a reference has not been seen in original, it should be indicated by an asterisk and the name of the abstracting journal or other source should be mentioned in brackets. If the title is in a language other than English, the diacretic signs, etc., should be precisely given as in the original.

Examples:

Text: (Patel, 1948); but, e.g., 'Patel (1948) showed that . . . .'. For two authors, write as, e.g., Khanna & Sharma (1947), using the ampersand (&). If there are more than two authors, all names should be given when cited for the first time and thereafter the first name only, adding *et al.*

References:

Raman, C. V. (1949) The theory of the Christiansen experiment. *Proc. Indian Acad. Sci.*, A, 29: 381-90.

Sahni, B. (1936a) Wegener's theory of continental drift in the light of Palaeobotanical evidence. *J. Indian bot. Soc.*, 15: 31-32.

Sahni, B. (1936b) The Karewas of Kashmir. *Curr. Sci.*, 5: 10-16.

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THE FUNGI OF INDIA — A SECOND SUPPLEMENT

BY

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(Accepted for publication, 2nd May, 1952)

Two lists of Indian fungi have been published so far, one by Butler and Bisby (*The Fungi of India*, 1931) and the other by Mundkur (*Fungi of India — Supplement I*, 1938). Of these, the former dealt with the period up to 1931 and the latter from 1931-1938. Butler and Bisby listed 2351 fungi, but did not include the Myxomycetes. Mundkur in his supplement listed 517 fungi including 74 belonging to the Myxomycetes, bringing the total number of fungi recorded for India to 2868.

Since then considerable work has been done in this country in systematic mycology. It was thought that the preparation of a second supplement to Butler and Bisby's list would therefore be useful. The present list is the result. It deals with the period 1938-1951, inclusive.

Many fungi have been recorded or described during this period from areas which are now in Pakistan; these have been omitted from this list.

Analytical data on the number of fungi recorded etc., are given in the following table.

	Phycomycetes	Ascomycetes	Uredinales	Ustilaginales	Other Basidiomycetes	Fungi Imperfecti	Total
New species	26	97	83	54	28	96	384
New varieties	6	2	..	4	..	5	17
Other species recorded for the first time in India	29	42	73	46	67	145	397
Other varieties recorded for the first time	..	..	..	..	..	7	7
Forms	..	..	..	..	2	..	2
Total	61	141	156	104	97	253	812

The number of fungi recorded during the period is 812. Thus, the total number of fungi recorded so far is 3680. Sixteen generic names have been proposed, one in the Phycomycetes, one in the Ascomycetes, eleven in the Uredinales, one in the Ustilaginales, and two in the Fungi Imperfecti. Of these, three in the Uredinales have been reduced to synonymy.

The fungi are arranged in alphabetical order under genera. The citation of each generic name is followed by a reference to Saccardo's *Sylloge Fungorum* (Vols. I-XXV), wherein a description of the genus could invariably be found. Where a genus name is not listed in the *Sylloge,* the original citation of the genus itself is given. In citing the authority for the generic names, we have followed Ainsworth and Bisby's "A Dictionary of the Fungi", 2nd Edition, 1945. After every generic name, its systematic position (class and order) is indicated and in certain cases the families or spore groups also, following Ainsworth and Bisby's Dictionary; e.g., **Aegerita** Imp., Moniliales (A 1) would mean that the fungus belongs to the spore group Hyalosporae, Amerosporae in the order Moniliales of the Fungi Imperfecti. In the case of the Uredinales and the Ustilaginales the numbers in brackets indicate the families: Uredinales, 1. Melampsoraceae, 2. Pucciniaceae; Ustilaginales, 1. Ustilaginaceae, 2. Tilletiaceae. Table 1 gives details of the symbols used by Ainsworth and Bisby to indicate spore groups.

The species are listed alphabetically within each genus, and where possible, the reference in Saccardo's *Sylloge* is given, e.g., **Aecidium crini** Kalchbr., **(Sacc. VII,** 82).

The following abbreviations have been used in the citation of literature in the text:

BB Butler & Bisby: *The Fungi of India,* 1931.
M Mundkur: *Fungi of India, Supplement I,* 1938.
RS Review of Applied Mycology, Supplement.
RS 2 Review of Applied Mycology, Index of Fungi, Vol. II.
Sacc. Saccardo, P. A.: *Sylloge Fungorum.*

Nomenclatural changes of some fungi listed by Butler and Bisby or Mundkur are indicated within square brackets.

A list of hosts and substrata arranged alphabetically is included* for the fungi listed.

* To appear in *J. Madras Univ. B, XXII,* No. 2.

TABLE 1.

	A 1-celled	B 2-celled	C 3-or more-celled	D Muriform	E Filiform	F Spirally coiled	G Star-like
1. Spores hyaline or bright	Hyalosporae	Hyalodidymae	Hyalophragmae	Hyalodictyae	Scolecosporae	Helicosporae	Staurosporae
2. Spores dark	Phaeosporae	Phaeodidymae	Phaeophragmae	Phaeodictyae			

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We are deeply indebted to Professor T. S. Sadasivan for much encouragement. We are grateful to many workers who kindly sent us reprints of their publications. We thank the Principal, Agricultural College, Coimbatore ; the Director, Indian Agricultural Institute, New Delhi ; and the Superintendent, Indian Botanic Gardens, Calcutta, for having kindly sent us various journals on loan.

ABSIDIA Van Tiegh. (**Sacc. VII**, 214) Phyco., Mucorales (2).

A. blakesleeana Lendner (**170**: 333). On fruits of *Nephelium litchi*. Calcutta.

ACERVULOPSORA Thirum. in *Mycologia*, **37**: 299· 1945. Basidio., Uredinales.

A. ichnocarpi (Barclay) Thirum. (**200**: 300; **Sacc. XI**: 226 and **BB**: 78, as *Uredo ichnocarpi*). On leaves of *Ichnocarpus frutescens*. Yeshwantpur. Mysore.

ACHLYA Nees ex? Pringsh. (**Sacc. VII**: 274) Phyco, Saprolegniales (1).

A. androcomposita Hamid (**59**: 206). Water, Amritsar, Hoshiarpur.

ACHORELLA Theiss. & Syd. (**Sacc. XXIV**: 548) Asco., Dothideales (3).

A. plectroniae Ramakr. T. S· and K. (**152**: 34). On leaves of *Plectronia didyma*, Kallar, Coimbatore Dt. (as *Achroella*).

A. vaccinii Ramakr. T. S. (**146**: 64). On leaves of *Vaccinium leschnaultii*, Kodaikanal.

AECIDIUM Pers. (**Sacc. VII**: 774) Basidio., Uredinales.

[**A. crini** Kalchbr. (**Sacc. VII**: 827; **115**: 16; **BB**: 51 as *A. amaryllidis* Syd. and Butl·). On leaves of *Crinum asiaticum*, Nandi Hills, Mysore, Thirumuti (Madras); *Crinum* sp. Pusa (Bihar); *Amaryllis* sp., Dehra Dun (U. P.); *Pancratium* sp., Poona.]

[**A. hederae** Wakef. (**44**: 446; as *A. hederae* Arth. and Cumm. in **M**: 20). On *Hedera helix*, Murree. This species was published by Arthur and Cummins (*Mycologia* **25**: 398. 1933) as a new species; but this was antedated by Wakefield's publication (*Kew Bull.* 1931, p. 202). The rusts are clearly identical, fide Cummins.]

A. marsdeniae Ramakr. T· S. and K. (**156**: 57). On leaves of *Marsdenia volubilis*, Burliar, Nilgiris. (but see *A. marsdeniae* Syd., 1937).

A. memecyli Thirum. (**203**: 245). On *Memecylon* sp. (? *umbellatum*), Nandi Hills, Mysore.

A. paramignyae Racib. (**218**: 231; **Sacc. XXI**: 758). On leaves of *Paramignya* sp. Balehonnur, Mysore.

A. plectranthicola Cummins (**44**: 447). On *Plectranthus coetsa*, Landour, Himalaya.

A. pulneyensis Ramakr. and Sriniv. (**144**: 46). On living stem and leaves of *Canarium commune*, Kodaikanal.

A. ranunculacearum DC. (**44**: 447; **Sacc. VII**: 776; doubtfully recorded in BB: 54)· On *Ranunculus hirtellus*, Deosai Plains, toward Skardu.

A. saussureae Johans.? (**44**: 447; **Sacc. VII**: 343, under *Puccinia vaginatae* Juel). On *Saussurea candolleana*, above Chorwan.

A. stewartianum Cummins (**44**: 447). On *Heracleum candicans*, near Taubat, Kishenganga Valley, Kashmir.

A. terminaliae Ramakr. T. S. and K. (**152**: 43). On leaves of *Terminalia bellerica*, Valparai, Anamalais.

AEGERITA Pers. ex Fr. (**Sacc. IV**: 661) Imp., Moniliales (6A1).

A. webberi Fawcett (**134**: 189; **Sacc. XXII**: 1465). On *Aleyrodes* sp., Benares.

ALLOMYCES Butler (**Sacc. XXIV**: 31) Phyco., Blastocladiales.

A. anomalus Emerson (**55**: 84, **133**: 136). Isolated from soil, type locality where Butler collected *Allomyces*, Pusa, Darbhanga, Bihar. Coll. L. D. Galloway.

[**A. arbusculus** Butler (**55**: 78; **Sacc. XXIV**: 32; **BB**: 2, as *A. arbuscula*). Emerson

(55: 78) says: "According to Article 72 of the International Rules, generic names ending with -myces are masculine. Hence the specific name *arbusculа* Butl. should be *arbusculus* to agree in gender with the generic name *Allomyces.*"]

A. javanicus Kniep (55: 83). Isolated from soil, type locality where Butler collected *Allomyces*, Pusa, Darbhanga, Bihar, Coll. L. D. Galloway.

A. javanicus Kniep v. **javanicus** Emerson (55: 113, 135). In soil, India.

A. javanicus Kniep v. **macrogynus** Emerson (55: 113, 135). In soil, India.

ALTERNARIA Nees ex Wallr. (**Sacc. IV**: 545) Imp., Moniliales (4D).

[**A. brassicicola** (Schw.) Wiltshire (246: 8-12; as *A. circinans* (Berk. and Curt.) Bolle in **BB**: 139). On *Brassica oleracea*, Pusa.]

A. carthami Chowdhury (38: 64). On leaves of *Carthamus tinctorius*, Pusa.

A. chartarum Preuss (170: 333-34; **Sacc. IV**: 546). On fruits of *Psidium guajava*, and *Zizyphus jujuba*, Calcutta.

A. spinaciae Allesch. and Noack (175: 104, without authority; **Sacc. XVI**: 1080). On *Spinacia oleracea*, Kanpur.

AMAZONIA Theiss. (**Sacc. XXIV**: 504) Asco., Erysiphales (2).

A. leeae Hansf. and Thirum. (61: 287). On leaves of *Leea macrophylla*, Balehonnur, Mysore.

ANGIOPSORA Mains in *Mycologia*, 26: 126. 1934. Basidio, Uredinales (2).

A. elephantopodis (Hiratsuka) Thirum. and Mundk. (225: 9; **Sacc. XXIII**: 921 as *Uredo elephantopodis* Petch). On leaves, stems and inflorescences of *Elephantopus Scaber*, Khunti, Ranchi, Bihar.

A. vernoniae Ramakr. (144: 43). On living leaves of *Vernonia bourneana*, Kodaikanal; Anamalais.

APHANOMYCES de Bary (**Sacc. VII**: 276) Phyco., Saprolegniales (1).

A. apophysii Lacy (69: 136). On *Spirogyra* sp., collected from a big pond, near village Bahadurpur, Patna.

ARMATELLA Theiss. and Syd. (**Sacc. XXIV**: 409). Asco., Hemisphaeriales (1).

A. cinnamomi Hansf. & Thirum. (61: 286). On leaves of *Cinnamomum zeylanicum*, Balehonnur, Mysore.

A. litseae (P. Henn.) Theiss. and Syd. (61: 286; **Sacc. XXIV**: 409). On *Neolitsea zeylanica*, Nandi Hills, Mysore.

ARRHENIA Fr. (**Sacc. V**: 498) Basidio., Agaricaceae.

A. cucullata (Jungh.) (6: 244). On dead leaves of *Saccharum munja*, Jaggatpur, Gurdaspur Dt.

ARTHRINIUM Kunze ex Fr. (**Sacc. IV**: 279) Imp., Moniliales (4A or 6).

A. sporophleum Kunze ex Fr. (124: 9; **Sacc. IV**: 279). On leaves, leaf-sheaths, and sheaths of the inflorescence of *Eriophorum comosum*, Nainital, U. P.

ARTHROBOTRYUM Ces. (**Sacc. IV**: 628) Imp., Moniliales (5C2).

A. cycadicola Thirum. (209: 175). On pinnae of *Cycas circinalis*, Bangalore.

ARTHURIA Jackson in *Mycologia*, 23: 463. 1931. Basidio., Uredinales (2).

A. tylophorae Ramakr. (144: 45). On living leaves of *Tylophora mollissima* and *T. tenuis*, Kodaikanal.

ASCHERSONIA Mont. (**Sacc. III**: 619) Imp., Sphaeropsidales (2C).

A. raciborskii Zimmerm. (136: 191). On *Aleyrodes* infesting the leaves of *Citrus aurantifolia*, Benares.

ASCOBOLUS Pers. ex Fr. (**Sacc. VIII**: 514) Asco., Pezizales (2).

A. glaber Pers. ex Fr. (9: 11; **Sacc. VIII**: 517). On rabbit dung, Rohtak (E. Punjab).

ASCOCHYTA Lib. (Sacc. III: 381) Imp., sphaeropsidales (1B1).

A. caricae Pat. (41: 317; Sacc. X: 299). On fruits of *Carica papaya*, Burnihat Fruit Res. Sta., Assam.

A. cyathulae Chona & Munjal (35: 345). On *Cyathula tomentosa*, Simla.

A. infortunata Ramakr. (146a: 163) on living leaves of *Clerodendion infortunatum*, Kallar (Coimbatore Dt.)

A. kashmiriana Padwick & Merh (127: 5). On living leaves of *Hyascyamus niger*, Aru, Kashmir (7900 ft.).

A. melongenae Padmanabhan (117: 394). On leaves of *Solanum melongena* seedlings, Jussore (Bengal).

A. santali Thirum. & Naras. (217: 72). On leaves of *Santalum album*, Nandi Hills, Mysore.

ASCOMYCETELLA Ellis (Sacc. VIII: 846) Asco., Myriangiales.

A. symploci Ramakr. (157: 69). On leaves of *Symplocos spicata*, Sim's Park, Coonoor, Nilgiris.

ASPERGILLUS Mich. ex. Fr. (Sacc. IV: 64) Imp., Moniliales (3A).

A. amstelodami (Mang.) Thom & Church (97: 63; Sacc. XXII: 25 as *Eurotium amstelodami*). Isolated as a common laboratory contaminant, Mycological laboratory, Indian Agricultural Res. Inst., Delhi.

A. japonicus Saito (139: 550; Sacc. XXII: 1257) On fruits of *Pyrus communis*, Delhi.

A. luchuensis Inui (170: 334; Sacc. XVIII: 515). On fruits of *Zizyphus jujuba*, Calcutta.

A. nanus Montag. (170: 334; Sacc. IV: 71). On fruits of *Zizyphus jujuba*, Calcutta. Thom & Raper (232: 231) suggest that "this may have represented young fruiting structures of a typical *A. niger*."

A. oryzae (Ahlburg) Cohn (54: 158 as *A. orizoae* Ahlburg). Possibly as a contaminant in culture media.

A. parasiticus Speare (170: 334; Sacc. XXV: 658). On fruits of *Zizyphus jujuba*, Calcutta.

A. phoenicis (Corda) Thom (170: 333-34; Sacc. VII: 459 as *Ustilago phoenicis*). On fruits of *Nephelium litchi* and *Psidium guajava*, Calcutta.

A. pseudo-nidulans Vuillemin (170: 333). On fruits of *Nephelium litchi*, Calcutta.

A. rugulosus Thom & Raper (97: 60). From exposed Petri dish in Mycological laboratory, Indian Agr. Res. Inst., Delhi.

A. unguis (Emil-Weil & Gaudin) em. Thom & Raper (97: 62). From exposed Petri dish, Mycological laboratory, Indian Agr. Res. Inst., Delhi.

A. variecolor (Berk. & Br.) Thom & Raper (97: 61; 232: 163; Sacc. VII: 154 as *Emericella variecolor;* 37: 61-63 as *E. medias;* 178: 200). From Bowenpilly, near Secunderabad; Lucknow; on mango fruits, U. P.

ASTERINA Lev. (Sacc. I: 39) Asco., Hemisphaeriales (3).

A. cansjericola Hansf. & Thirum. (61: 304). On leaves of *Cansjera rheedii*, Nandi Hills, Mysore.

A. dichapetali Hansf. & Thirum. (61: 305). On leaves of *Dichapetalum geloniodes*, Balehonnur, Mysore.

A. elaeagni (Syd.) Syd. & Petrak (61: 306). On *Elaeagnus conferta* (as *E. latifolia*), Balehonnur, Mysore.

A. erysiphoides Kalchbr. & Cooke (61: 306; Sacc. I: 47). On *Jasminum rigidum* Mysore.

A. garciniae Hansf. (60: 44). On leaves of *Garcinia mangostana*, Ooty.

A. mysorensis Hansf. & Thirum. (**61**: 307). On leaves of *Ficus* sp., Nandi Hills, Mysore.

A. olacicola Hansf. (**60**: 46). On leaves of *Olax wightiana*, Nandi Hills, Mysore.

ASTEROLIBERTIA Arnaud (**Sacc. XXIV**: 478) Asco., Hemisphaeriales (= *Asterina* fide Stevens & Ryan).

A. mangiferae Hansf. & Thirum . (**61**: 303). On leaves of *Mangifera indica*. Thirthahalli, Mysore.

ASTOMELLA Thirum. in *New Phytol.*, **46**: 271; 1947. Asco., Perisporiales.

A. neolitseae Thirum. (**205**: 272). On leaves of *Neolitsea zeylanica*, Nandi Hills, Mysore.

AURICULARIA Bull. ex Fr. (**Sacc. VI**: 762); but see Martin (**85**) who suggests "*Auricularia* Pers." as the correct name). Basidio., Tremellales (1).

[**A. auricularis** (S. F. Gray) Martin (**Sacc. VI**: 766, **BB**: 100 as *Hirneola auricula-judae*; **23**: 194 as *Auricularia auricula-judae*; **85**: 81-82). On dead bamboo, Calcutta; on trunks, etc., on tea stems.]

[**A. polytricha** (Mont.) **Sacc.** (**78**: 357; **6**: 242 as *A. polytricha* Mont.; **Sacc. VI**: 766, **BB**: 101 as *Hirneola polytricha* Mont. On dead branches of *Ficus bengalensis*, Jaggatpur, Gurdaspur; on wood, on dead twigs of *Tectona grandis*.]

A. fuscosuccinea (Mont.) Farl. (**78**: 352; **22**: 53 as *A. rosea* Burt). On dead branch, Calcutta.

A. tenuis (Lev.) Farl. (**22**: 53; **Sacc. XXI**: 442). On dead branches, Calcutta.

BAGNISIOPSIS Theiss. & Syd. (**Sacc. XXIV**: 390) Asco., Dothideales (3).

B. capparidis Mundk. & Ahmad, see *Penzigia capparidis*.

BALANSIA Speg. (**Sacc. IX**: 997) Asco., Hypocreales (E).

[**B. oryzae** (Syd.) Naras. & Thirum. (**116**: 276; **Sacc. XXV**: 535, **BB**: 156 as *Ephelis oryzae*). On inflorescence of *Oryza sativa*, Mysore (?)].

BATTARRAEA Pers. (**Sacc. VII**: 65 as *Battarrea*) Basidio., Sclerdermatales.

B. stevenii (Libosch.) Fr. (**1**: 49; **Sacc. VII**: 66). Solitary on the ground with volva hidden by the soil, Rohtak (E. Punjab).

BLASTOTRICHUM Corda (**Sacc. IV**: 191) Imp., Moniliales (3C).

B. chowdhuryi Pant (**128**: 180). In fruits of *Trichosanthes dioica*, Lucknow (?).

BOMBARDIA Fr. (**Sacc. I**: 277) Asco., Sphaeriales (A2).

B. hyalina Verma (**244**: 45). On dry twigs of *Thunbergia grandiflora*, Lucknow. (no Latin diagnosis).

BOTRYOBASIDIUM Donk in Nederl. Myc. Ver. Med., **18-20**; 116. 1931. Basidio., Thelephoraceae.

B. album (Dastur) Venkatarayan, see *Pellicularia alba*.

B. rolfsii (Sacc.) Venkatarayan, see *Pellicularia rolfsii*.

B. salmonicolor (Berk, & Br.) Venkatarayan, see *Pellicularia salmonicolor*.

BOTRYOSPHAERIA Ces. & de Not. (**Sacc. I**: 456) Asco., Sphaeriales (A1).

B. prosopidis Mundk. & Ahmad (**110**: 3). On dead branches of *Prosopis spicigera*, Rohtak (E. Punjab).

BOTRYOTINIA Whetzel in *Mycologia* **37**: 678. 1945. Asco. Sclerotiniaceae.

[**B. ricini** (Godfrey) Whetzel (*Mycologia* **37**: 680; **RS**: 146; **BB**: 13 as *Sclerotinia ricini* Godfrey). On inflorescence and fruits of *Ricinus communis*,

Mysore. **B. ricini** (Godfrey) Buchwald in K. Vet Hojsk. Aarsskr., 32: 137. 1950 is a later homonym.]

BOVISTA Pers. (**Sacc. VII:** 96) Basidio., Lycoperdales.

B. concinna Ahmad (10: 335). Solitary or gregarious on vegetable debris under trees of *Taxus baccata*, Upper Topu, Murree, 6000 ft.

B. plumbea Pers. (4: 179; **Sacc. VII:** 96). Sonamarg, Kashmir (9000 ft.), coll. R. R. Stewart. The fungus recorded under this name in **BB:** 134 is *Bovistella henningsii* Lloyd. See under *Bovistella henningsii*.

BOVISTELLA Morg. (**Sacc. XXI:** 481) Basidio Lycoperdales (= *Bovista* fide Cunningham).

[**B. henningsii** Lloyd (4: 179; **Sacc. XXI:** 482; **BB:** 134 as *Bovista plumbea*). Incorrectly recorded in **BB:** 134 as *Bovista plumbea* Pers, coll. Gollan. Record based on the specimen sent to Dr. Hennings for determination who referred it to this sp. One half of the same specimen was given to Lloyd by Hennings who refers it to *Bovistella* and calls it *Bovistella henningsii*. He remarks: "I feel sure it should not be referred to *Bovista plumbea*, as it has a cortex different from all known Bovistas (minute fasciculate persistent spines).....etc." The plant recorded in **BB:** 134 should be therefore designated *Bovistella henningsii* Lloyd.]

[**B. lycoperdioides** (Cooke) Lloyd (4: 179; **BB:** 138 as *Scleroderma cookei*). Sonamarg, Kashmir (9000 ft.) amongst moss. (**Sacc. VII:** 137 cites *B. lycoperdoides* (Schw.) Lloyd.)]

BREMIA Regel (**Sacc. VII:** 243) Phyco., Peronosporales (3).

[**B. ganglioniformis** (Casp.) Shaw (173: 326; **Sacc: VII:** 244, **BB:** 2 as *B. lactucae*) *On Lactuca dissecta, L. scariola, L. sp., Sonchus oleraceus, Conyza* sp.]

B. graminicola Naoumoff v. **indica** Patel (130: 105). On living leaves of *Arthraxon lancifolius*, Mahableshwar (Bombay St.)

BUBAKIA Arthur in *Result. sci. Congr. internat. Bot. Wien*, 1905, p. 338, 1906. Basidio., Uredinales (1).

[**B. cingens** (Syd.) Mundk. (103: 544; **Sacc. XXIII:** 841, **BB:** 77 as *Schroeteriaster cingens* Syd.). On leaves of *Bridelia tomentosa* v. *chinensis*, *B.* sp.]

B. indica Ramakr. T. S. & K. (157: 75). On leaves of *Glochidion neilgherrense*, Dodabetta (Nilgiris).

BULGARIASTRUM Syd. (**Sacc. XXIV:** 1241) Asco. Helotiales.

B. tumefaciens Ramakr. T. S. & K. (152: 33). On leaves and inflorescence of *Capparis sepiaria*, Kallar & Hasanur (Coimbatore).

BURRILLIA Setch. (**Sacc. XI:** 236) Basidio., Ustilaginales (2).

B. ajrekari Thirum. (204: 607). On leaves of *Monochoria vaginalis*, Bannerghatta, Bangalore.

B. narasimhanii Thirum. & Mundk. (225: 8; 204: 606 as *nomen nudum*). On leaves of *Alisma reniforme*, Donayakapalya, Bellur, Mysore.

CALOCERA Fr. (**Sacc. VI:** 732) Basidio., Tremellales (3).

C. cornea Fr. (22: 53; **Sacc. VI:** 734). On decaying half buried wood, Calcutta.

C. striata (Hoffm.) Fr. (22: 53; **Sacc. VI:** 736). On decaying half buried wood, Calcutta.

CALONECTRIA de Not. (**Sacc. II:** 540) Asco., Hypocreales (C1).

[**C. theae** Loos (77: 17; **Sacc. XXV:** 747, **M:** 33 as *Cercosporella theae* Petch). On *Thea sinensis*, South India.]

CALVATIA Fr. (**Sacc. VII:** 105) Basidio., Lycoperdales.

C. coelata (Bull). Morgan (4: 181). On the ground, Babet Pass (18,000 ft.) Bashahr St. (Himachal Pradesh).

C. gigantea (Batsch. ex Pers.) Lloyd(4: 180; **Sacc. VII:** 109, **BB:** 136 as *Lycoperdon giganteum Batsch*). Sonamarg, Kashmir (9000 ft.).

CAMAROTELLA Theiss. & Syd. (**Sacc. XXIV:** 620) Asco., Dothideales.

C. symploci Ramakr. T. S. & K. (**157:** 71). On leaves of *Symplocos foliosa*, Ootacamund.

CANDELOSPORA Rea & Hawley in Proc. Roy. Irish Acad., 13: 11. 1912. Imp., Moniliales (3C).

[**C. theae** (Petch) Wakefield ex Gadd (**RS** 2: 36; **Sacc. XXV:** 747, **M:** 33 as *Cercosporella theae* Petch). On *Thea sinensis*, S. India. See also *Calonectria theae*.]

CARPENTERELLA Tehon & Harris in *Mycologia* 32: 127. 1941. Phyco., Chytridiales (3).

C. cannae Thirum. & Mundk. (225: 1). In rhizomes of *Canna indica*, Bangalore.

CATACAUMA Theiss. & Syd. (**Sacc. XXIV:** 559) Asco., Dothideales (= *Phyllachora* fide Petrak).

C. elaeocarpi Ramakr. T. S. & K. (**153:** 57; **157:** 72). On leaves of *Elaeocarpus munroi*, Coonoor (Nilgiris); of *Elaeocarpus oblongus*, Ootacamund.

C. elettariae Ramakr. T. S. & K. (**158:** 100). On leaves of *Elettaria cardamomum*, Papanasam (Tinnevelly Dt.).

C. himalayanum Padwick (**123:** 4). On living leaves of *Ficus faveolatus*, Mussoori, U.P.

CATACAUMELLA Theiss. & Syd. (**Sacc. XXIV:** 564) Asco., Dothideales.

C. calamicola Ramakr. T. S. & K. (**159:** 208). On leaves of *Calamus rotang*, Coonoor (Nilgiris).

CATENULOPSORA Mundkur in *Ann. Bot.*, Lond., *N.S.*, 7: 216. 1943. Basidio, Uredinales.

C. flacourtiae Mundk. & Thirum. (**113:** 217; **115:** 16; **Sacc. XXI:** 790, **M:** 23 as *Uredo uguressae* Petch). On leaves of *Flacourtia sepiaria*, Yeshwantpur, Mysore; *F. ramontchi*, Mahjgawan (U.P.), uredial stage only.

C. grewiae Thirum. & Mundk. (**225:** 13). On leaves of *Grewia betulaefolia* (as *G. populifolia*), Rhotak, Punjab.

[**C. vitis** (Butl.) Mundk. & Thirum. (**113:** 218; **126:** 4; **Sacc. XXIII:** 790 as *Kuehneola vitis* (Butl.) Syd.; **BB:** 56 as *Cerotelium vitis* (Butl.) Arth.). On *Ampelocissus latifolia*, Rangpur; *Vitis adnata*, Comilla; *V. trifolia*, Simla.]

C. zizyphi Ramakr. & Subram.(**166:** 262). On *Zizyphus oenoplia*, Fruit Res. Station, Kallar.

CERCOSPORA Fres. (**Sacc. IV:** 431) Imp., Moniliales (4E).

C. achyranthes Syd. (**131:** 148). On *Achyranthes aspera*, Poona.

C. achyranthina Thirum. & Chupp (**221:** 352). On *Achyranthes aspera*, Bangalore.

C. adinae Ramakr. T. S. & K. (**149:** 10). On leaves of *Adina cordifolia*, Walayar (Malabar).

C. anonae Mueller & Chupp (**110:** 10). On leaves of *Annona squamosa*, Shehdpur, Pusa (Bihar).

C. apii Fres. v **carotae** Pass. (**123:** 13; Sacc. X: 624). On leaves of *Daucus carota*, Srinagar, Kashmir.

C. asplenii Jaap (**221:** 353; Sacc. **XXV:** 877). On leaves of *Asplenium nidus*, Bangalore.

C. bangalorensis Thirum. & Chupp (**221**: 353). On *Aristolochia indica*, Bangalore.

C. barlericola Payak & Thirum. (**136**: 191). On leaves of *Barleria cristata*, Benares Hindu University, Benares.

C. bombacina Ramakr. T. S. & K. (**159**: 212). On leaves of *Bombax malabaricum*, Walayar (Malabar).

C. canavaliae Syd. (**110**: 10) Sacc. **XXV**: 879). On leaves of *Canavalia ensiformis*, Kanpur (U. P.).

C. canescens Ell. & Mart. (**221**: 354; Sacc. **IV**: 435). On leaves of *Vigna catjang*, Bangalore.

C. cannabis Hara & Fukui (**221**: 354). On leaves of *Cannabis sativa*, Goribidnur, Mysore.

C. capparidicola Hansf. & Thirum. (**61**: 307). On leaves of *Capparis sepiaria*, Nandi Hills, Mysore.

C. capparidis Sacc. (**221**: 354; Sacc. **IV**: 435). On leaves of *Capparis zeylanica* (as *C. horrida*), Bangalore.

C. carbonacea Miles (**221**: 354; Sacc. **XXV**: 874). On *Dioscorea alata* (?), Nandi Hills, Mysore.

C. careyae Ramakr. T. S. & K. (**158**: 105). On leaves of *Careya arborea*. Gudalur (Nilgiris).

C. cascariae Stevens (**110**: 10; Sacc. **XXV**: 877). On leaves of *Cascaria tomentosa*, Rajpur (U. P.).

C. chrysanthemi Heald & Wolf (**131**: 148; Sacc. **XXV**: 871). On leaves of *Chrysanthemum* sp., Bombay State.

C. citrullina Cooke (**110**: 10; Sacc. **IV**: 452). On leaves of *Citrullus vulgaris*, Pusa (Bihar).

C. clauseniae Thirum. & Chupp (**221**: 354). On *Clausenia willdenowii*, Nandi Hills, Mysore.

C. consimilis Syd. (?**21**: 355). On leaves of *Vernonia* sp., Koppa Road, Mysore.

C. corchorica Petrak & Ciferri (**110**: 10). On leaves of *Corchorus trilocularis*, Rohtak (E. Punjab); *C. olitorius*, Godagiri (Bengal); *C. sp.*, Pusa (Bihar).

C. dalbergicola Ramakr. T. S. & K. (**158**: 106). On leaves of *Dalbergia volubilis*, Walayar (Malabar).

C. eucalypti Cooke & Mass. (**158**: 107; Sacc., **X**: 644). On leaves of *Eucalyptus ficifolia*, Ootacamund.

C. ferruginea Fuckel (**127**: 7; **146a**: 163; Sacc., **IV**: 444). On leaves of *Artemisia vulgaris*, Mussoorie (7000 ft.); Anamalais.

C. fusimaculans Atk. (**221**: 355; Sacc. **X**: 655). On leaves of *Urochloa panicoides* (as *Panicum javanicum*), Bangalore.

C. hibiscina Ell. & Ev. (**221**: 355; Sacc. **XIV**: 1099). On leaves of *Hibiscus cannabinus*, Bangalore.

C. holarrhenae Thirum. & Chupp (**221**: 355). On leaves of *Holarrhena antidysenterica*, Balehonnur, Mysore.

C. ixorae Yamamoto (**221**: 356). On leaves of *Ixora parviflora*, Channapatna, Nandi Hills (Mysore). **M**: 32 records *C. ixorae* Solheim.

C. jasminicola Mueller & Chupp (**110**: 10; **221**: 356; **131**: 148). On leaves of *Jasminum malabaricum*, Dharwar (Bombay); *J. sambac*, Dharwar; *J. rigidum*, Bangalore, Nandi Hills (Mysore); *J.* sp., Pusa (Bihar).

C. kaki Ell. & Ev. (**221**: 356; Sacc. **X**: 648). On leaves of *Diospyros melanoxylon* (*as D. tupru*), Bangalore, Nandi Hills (Mysore).

C. kallarensis Ramakr. T. S. & K. (153: 69). On leaves of *Ficus* sp., Kallar (Coimbatore).

C. lettsomiae Thirum. & Chupp (221: 356). On leaves of *Lettsomia elliptica*, Bangalore.

C. mali Ell. & Ev. (110: 10; 221: 357; **Sacc. X**: 643). On leaves of *Pyrus malus*, Hessarghatta (Mysore), Bangalore.

C. moricola Cooke (131: 148; **Sacc. IV**: 475). On leaves of *Morus alba*, Dharwar (Bombay).

C. mysorensis Thirum. & Chupp (221: 357). On leaves of *Pouzolzia bennettiana*, Nandi Hills (Mysore).

C. nerii-indici Yamamato (221: 358). On leaves of *Nerium oleander*, Tirumalai, Tirupati.

C. panacis Thirum. & Chupp (221: 358). On leaves of *Panax fruticosa*, Bangalore,

C. pancratii Ell. & Ev. (115: 26; **Sacc. X**: 654). On leaves of *Crinum* (?) *asiaticum*, Bangalore.

C. paramignyae Thirum. & Chupp (221: 358). On leaves of *Paramignya* sp., Balehonnur, Mysore.

C. petila Thirum. & Chupp (221: 359). On leaves of *Euphorbia pulcherrima*, Bangalore.

C. physalidis Ell. (110: 10; **Sacc. IV**: 450). On leaves of *Physalis minima*, Rohtak (E. Punjab).

C. pilosa Ramakr. (146: 69). On leaves of *Triumfetta pilosa*, Kodaikanal.

C. piperata Asthana & Mahmud (13: 58). On leaves of *Piper longum*.

C. pulchella Ramakr. (146a: 164). On living leaves of *Indigofera pulchella*, Kodaikanal.

C. sapindi-emarginati Ramakr. T. S. & K. (158: 107). On leaves of *Sapindus emarginatus*, Anakapalle (Vizagapatnam Dt.).

C. schreberae Mahmud (80: 292, without latin diagnosis). On *Schrebera swietenioides*, Nagpur.

C. shoreae Thirum. & Chupp (221: 360). On leaves of *Shorea talura*, Bangalore.

C. sojina Hara (221: 360). On leaves of *Glycine javanica*, Bangalore.

C. sophorae Ramakr. T. S. & K. (159: 213). On leaves of *Sophora glauca*, Nanjanad (Nilgiris).

C. tectonae Stevens (221: 361). On leaves of *Tectona grandis*, Bangalore.

C. teucrii Ell. & Kellerm. (110: 10; **Sacc. IV**: 446). On leaves of *Anisomeles indica* (as *A. ovata* v. *mollisima*), Rohtak (E. Punjab).

C. tinosporae H. & P. Syd. (221: 361, **Sacc. XXV**: 884). On leaves of *Tinospora cordifolia*, Bangalore. See **M**: 15, under *Mycosphaerella tinosporae*.

C. tylophorae Ramakr. T. S. & K. (158: 108). On leaves of *Tylophora asthmatica*, Walayar (Malabar).

C. vestita Ramakr. (146: 69). On leaves of *Leucas vestita*, Kodaikanal.

C. waltheriae Thirum. & Chupp. (221: 361). On leaves of *Waltheria indica*, Bangalore.

C. wrightiae Thirum. & Chupp (221: 362). On leaves of *Wrightia tinctoria*, Bangalore.

C. zizyphi Petch (110: 10; 221: 362; **Sacc. XXII**: 1417). On leaves of *Zizyphus nummularia*, Rohtak (E. Punjab): *Z. oenopolia*, Kemmangudi (Mysore).

CERCOSPORELLA Sacc. (**Sacc. IV**: 218) Imp., Moniliales (3E).

C. anethi Sacc. (131: 148; **Sacc. XXV**: 747). On leaves of *Anethum graveolens*, Poona.

C. azimae Thirum. & Naras. (217: 66). On leaves of *Azima tetracantha*, Channapatna, Mysore.

C. leucadis Uppal, Patel & Bhide (238: 177). On *Leucas stelligera* and *L. ciliata*, Mahableshwar (Bombay).

C. thespesiae Thirum. & Naras. (217: 66). On leaves of *Thespesia populnea*, Lakkavalli, Mysore.

C. triumfettae Thirum. & Naras. (217: 67). On leaves of *Triumfetta rhomboidea*, Bangalore.

CEROTELIUM Arthur in *Bull. Torrey bot. Cl.*, 33: 30. 1906 (as "*Ceratelium*") Basidio., Uredinales (1 or 2).

C. wagateae Thirum. & Gopalkr. (203: 237). On *Wagatea spicata*, Balehonnur, Mysore.

CHACONIA Juel (Sacc. XIV: 290). Basidio., Uredinales (1 or 2).

[C. butleri (Syd.) Mains (144: 47; 81: 628; Sacc. XXIII: 665, BB: 55 as *Blastospora butleri* Syd. On living leaves of *Jasminum brevilobum*, Kodaikanal.]

C. tectonae Ramakr. T. S. & K. (154: 19; 131: 145, 210: 176 as *Olivea tectonae*). On leaves of *Tectona grandis*, Walayar (Malabar), Bombay, Bangalore.

CHAETOMIUM Kunze ex Fr. (Sacc. I: 220) Asco., Sphaeriales (A2).

C. chartarum Berk. (24: 98). From raw jute fibre, Calcutta.

CHAETOTHYRIUM Speg. (Sacc. IX: 1061) Asco., Dothideales (1).

C. mysorensis Hansf. & Thirum. (61: 301). On leaves of *Salacia* sp., Balehonnur, Mysore.

CHLAMYDOMYCES Bain.. (Sacc. XXII: 1309) Imp., Moniliales (3B).

C. palmarum (Cooke) Mason (110: 11). On leaves of *Elettaria cardamomum*, Pollibetta (Coorg.); *Piper longum* and *Rubus niveus* (as *R. lasiocarpus*). Balehonnur (Mysore).

CHOANEPHORA Currey (Sacc. IX: 339 cites: *Choanophora* Cunningham) Phyco., Mucorales (6).

C. trispora (Thaxter) Sinha (177: 174; Sacc. XXIV: 6 as *Blakeslea trispora*). On *Colocasia antiquorum*, Lucknow.

CHRYSOCELIS Lagerh. & Diet. (Sacc. XXIII: 664) Basidio., Uredinales (2).

C. ascotela (Syd.) Thirum., see *Maravalia ascotela*.

C. indica Ramakr. T. S. & K. (156: 49). On leaves of *Justicia betonica*, Burliar (Nilgiris).

CHYTRIDIUM Braun (Sacc. VII: 304) Phyco., Chytridiales (8).

C. olla Braun (69: 136). On Oedogonium sp., Bahadurpur, Patna.

CINTRACTIA Cornu (Sacc. VII: 480) Basidio., Ustilaginales (1).

[C. axicola (Berk.) Cornu (135: 107; Sacc. VII: 480; BB: 43; 40; 231 as *C. mundkuri*). On *Fimbristylis quinquangularis*, Yelwal (Mysore); *F. annua* v. *diphylla*, Mukkamala (Godavary); *F.* sp., Erramacola (Wynaad); Nagpur; *F. diphylla*, Habiganj, Assam; *F. dichotoma*, Amritsar (E. Punjab); *F. tenera*, Rohtak, (E. Punjab). C. *mundkuri* Chowdhury is considered a synonym of C. *axicola* by Pavgi & Mundkur (135).]

C. caricis (Pers.) Magnus (107: 291; 135: 107; Sacc. VII: 464). On *Carex cardiolepis* Sonamarg, Kashmir (10,000 ft.).

C. disciformis Liro (72: 129). On *Carex haematostoma*, Mt. Sawi, 13,000 ft., Sonamarg, Kashmir.

C. elynae Syd. (107: 290). In ovaries of *Kobresia capillifolia*, Burzil Chowki, Kashmir (12,000 ft.).

C. fimbristylicola Pavgi & Mundk. (135: 108). On *Fimbristylis complanata*, Chatrapur, Ganjam (Orissa).

C. kobresiae Mundkur (**107**: 291). In ovaries of *Kobresia laxa*, Satpura nulla, above Skardu (Kashmir).

C. leioderma (Lagerh.) Ciferri (**135**: 108). On *Carex incurva*, below Babet Pass, Bashahr (Himachal Pradesh).

C. mundkuri Chowdhury, see *C. axicola* (Berk.) Cornu.

[**C. peribebuyensis** (Speg.) Speg. (**135**: 108; **239**: 13; **BB**: 44; **Sacc. VII**: 458; **169**: 325, **136**: 191 as *C. minor* (Clinton) Jackson). On *Cyperus rotundus*, Yellareddy (Hyderabad Deccan), Hebbal, Bangalore; *C.* sp., Pusa, Awapur (Muzaffarpur Dt.), Almore (Godavari), Samalkot (Madras), Nagpur, Lonavala (Bombay), Bilikere (Mysore); *C. compressus*, Hebbal, Bangalore; *C. pangorei*, Bangalore, Benares. Pavgi & Mundkur (**135**) consider *C. minor* (Clinton) Jackson a synonym of *C. peribebuyensis*.]

C. peribebuyensis (Speg.) Speg. v. **major** Pavgi & Mundk. (**135**: 109). On *Cyperus* sp., Coconada (Madras).

C. scleriae-lithospermi Thirum. (**216**: 173).In the ovaries of *Scleria lithosperma* v. *roxburghii*, Lakkavalli (Mysore).

CLADOCHYTRIUM Nowakowski (**Sacc. VII**: 295) Phyco. Chytridiales (6).

C. aneurae Thirum. (**207**: 8). On the thallus of *Aneura* sp., Augumbe, Mysore.

CLADOSPORIUM Link ex Fr. (**Sacc. IV**: 350) Imp., Moniliales (4B).

C. calotropidis Stevens (**131**: 149; Sacc. **XXV**: 789). On leaves of *Calotropis gigantea*, Poona.

C. macrocarpum Preuss (**175**: 104, without authority; **Sacc. IV**: 352). On *spinacia oleracea*, Kanpur.

CLATHRUS Mich. ex Pers. (**Sacc. VII**: 18) Basidio., Phallales.

C. delicatus Berk. & Br. (**23**: 194 as *C. delicatus* Berk.; **Sacc. VII**: 20). On dead bamboo, Calcutta.

CLAVARIA Vaill. ex Fr. (**Sacc. VI**: 692) Basidio., Agaricales.

C. angulispora Pat. (**22**: 41; **Sacc. IX**: 247 as *Clavaria? anguilispora* Pat.). On humus, Calcutta.

C. compressa Schw. (**22**: 41; **Sacc. VI**: 709). On humus, Calcutta. Banerjee (**22**) cites *C. fusiformis* (**BB**: 88) as a synonym of this species.

C. laeticolor Berk & Curt. (**22**: 41; **Sacc. VI**: 725). On ground among fallen leaves, Calcutta.

C. pistillaris L. (**9**: 11; **Sacc. VI**: 722). On the ground, Murree.

C. pulchra Peck (**22**: 41; **Sacc. VI**: 725). On earth among decaying leaves, Calcutta.

CLAVICEPS Tul. (**Sacc. II**: 564) Asco., Hypocreales (E).

C. paspali Stevens & Hall (**167**: 214; **Sacc. XXII**: 508). On *Paspalum scrobiculatum* and *Rhynchelytrum roseum*, Coimbatore.

C. purpurea (Fr.) Tul. (**124**: 11; **Sacc. II**:564). In inflorescence of *Brachypodium sylvaticum*, Nainital (U.P.), Himalayan foot-hills of the Punjab and the U. P.

C. pusilla Cesati (**167**: 214; **Sacc. VI**: 565). On *Rhynchelytrum roseum*, Coonoor, Nilgiris.

C. viridis Padwick and Azmatulla (**125**: 257). On *Oplismenus compositus*, Simla.

CLAVICORONA Doty in *Lloydia* **10**: 38. 1947. Basidio., Hymenomycetes.

[**C. pyxidata** (Fr.) Doty (*Lloydia* **10**: 43; **Sacc. VI**: 698, **BB**: 88 as *Clavaria pyxidata* Pers.). On wood, Arnigadh, Mussoori.]

CLAVULINOPSIS van Overeem in *Bull. Jard. bot. Buitenz.*, Ser. III, 5: 278. 1923. Basidio., Agaricales (= *Clavaria*).

[**C. corniculata** (Fr.) Corner (**43**: 362; **BB**: 87 as *Clavaria corniculata* Schaeff.; **Sacc. VI**: 694 as *Clavaria corniculata* under *Clavaria muscoides* L. as a synonym). Sonamarg. Kashmir. Doty (*Lloydia*, **13**: 14) proposes the name *Donkella corniculata* (Fr.) Doty for the same fungus. See under *Donkella corniculata*].

[**C. fusiformis** (Fr.) Corner (**43**: 367; **Sacc. VI**: 718, **BB**: 88 as *Clavaria fusiformis* Sowerby). India.]

COLEOSPORIUM Lev. (**Sacc. VII**: 751) Basidio., Uredinales (1).

C. barclayense Bagchee (**16**: 53). On *Senecio rufinervis, S. alatus, Pinus excelsa*, Himalayas.

C. satyrii Mundk. & Thirum. (**115**: 7).On leaves of *Satyrium nepalense*, Goovaldam (U. P.).

COLEROA (Fr.) Rabenh. (**Sacc. XXII**: 153) Asco., Sphaeriales (= *Niesslia*).

C. potentillae (Fr.) Cooke (**185**: 442; **Sacc. I**: 594 as *Venturia potentillae* (Fr.) Cooke). On leaves of *Potentilla atro-sanguinea*, Kara, Babet Pass (Himachal Pradesh).

COLLETOTRICHUM Corda (**Sacc. III**: 735) Imp., Melanconiales (A1).

C. ciliatum Ramakr. T. S. & K. (**148**: 185). On leaves of *Cymbopogon polyneuros*, Nanjanad (Nilgiris).

C. compactum Ramakr. (**146**: 70). On pods of *Albizzia lebbeck*, Coimbatore.

C. falcatum Went v. **arundinis** Ramakr. (**142**: 293). On leaves of *Arundo donax*, Coimbatore.

C. ficus Koord. (**95**: 188; **Sacc. XXII**: 1204). On *Hevea brasiliensis*, Valiamully Estate, S. Travancore.

C. spinaciae Ell. & Halst. (**176**: 239; **Sacc. X**: 469). On leaves, stem and seeds of *Spinacia oleracea*, Kanpur.

COLTRICIA Mich. ex S. F. Gray (**Sacc. XVI**: 1249 gives *Coltricius* Gray=*Boletus*). Basidio., Polyporaceae (= *Polystictus* fide Sacc.)

[**C. acupunctata** (Berk.) Cunningham (**46**: 216; **BB**: 130 as *Trametes acu-punctata*, cited as a synonym of *Polystictus aratus* Berk. in **Sacc. VI**: 279). On dead wood, Dhoni Forest, Malabar.]

[**C. schweinitzii** (Fr.) Cunningham (**46**: 241; **Sacc. VI**: 76, **BB**: 119 as *Polyporus schweinitzii* Fr.). On the ground, Botanical Garden, Saharanpur; Himalayas.]

CONIOTHYRIUM Sacc. (**Sacc. III**: 305 gives the authority as "Corda em. Sacc.") Imp., Sphaeropsidales (1A2).

C. arecae Padwick & Merh(**127**: 4). On living leaves of *Areca catechu*, Titabar, Assam.

C. olivaceum Bon. (**123**: 8; **Sacc. III**: 305). On dead branches of *Pyrus malus*, Sopore, Kashmir.

COPRINUS (Pers. ex Fr.) S. F. Gray (**Sacc. V**: 1078) Basidio., Agaricaceae.

C. micaceous (Bull.) Fr. (**22**: 42; **Sacc. V**: 1090). About stumps, trees and fence posts, Calcutta.

CORBULOPSORA Cummins in *Mycologia* 32: 364. 1940. Basidio., Uredinales.

C. cumminsii Thirum. (**203**: 235). On leaves of *Lactuca runcinata*, Hebbal, Bangalore.

CORDYCEPS (Fr.) Link (**Sacc. II**: 566) Asco., Hypocreales (E).

C. sphecocephala (Klotzsch.) Sacc. (**172**: 254; **Sacc. XIX**: 426 as *C. sphecophila* (Kl.) Berk. & Curt.). On *Pompilus* sp., Agarpara, near Calcutta.

CORIOLUS Quel. (**Sacc. VI**: 253) Basidio., Polyporaceae (= *Polystictus* fide Sacc.)

[**C. sinulosus** (Klotzsch.) Cunningham (**46**: 242; **Sacc. VI**: 384, **BB**: 92 as *Daeda-*

lea sinulosa Klotzsch). On wood, India.]

CORTICIUM Pers. ex Fr. (**Sacc. VI:** 603 as *Corticium* Fr.) Basidio., Thelephoraceae.

C. album Dastur, see *Pellicularia alba.*

C. dealbans Tunstall & Sarmah (Mem. Tocklai Exp. Sta., **16:** 76. 1947). On *Thea sinensis* (as *Camellia sinensis*), India.

CRONARTIUM Fr. (**Sacc. VII:** 597) Basidio., Uredinales (1).

C. fici Ramakr. T. S. & K. (**156:** 50). On leaves of *Ficus* sp., Burliar (Nilgiris).

C. quercuum (Berk.) Miyabe (**15:** 219; **Sacc. VII:** 837 as *Peridermium cerebrum* Peck). On *Pinus insularis* and *Quercus griffithsii,* Shillong, Assam.

CROSSOPSORA Syd. (**Sacc. XXIII:** 854) Basidio., Uredinales (1).

C. premnae-tomentosae Ramakr. & Soumini (**162:** 36). On living leaves of *Premna tomentosa,* Kallar (Coimbatore).

CRYPTOSTICTIS Fuckel (**Sacc. III:** 443) Imp., Melanconiales (C2).

C. caudata (Preuss) Sacc. (**131:** 146; **Sacc. III:** 444). On leaves of *Rosa* sp., Karjat.

CURVULARIA Boedijn in *Bull. Jard. bot. Buitenz.,* Ser. III, **13:** 123, 1934. Imp., Moniliales (4C).

[**C. lunata** (Wakker) Boedijn(**27:** 127; **120:** 36; **Sacc. XIV:** 1089, **BB:** 139 as *Acrothecium lunatum* Wakker). On leaves of *Sorghum vulgare, Setaria italica, Panicum frumentaceum, Eleusine coracana;* male inflorescence of *Zea mays;* soil, South India; On *Oryza sativa,* Bengal.]

[**C. penniseti** (Mitra) Boedijn (**27:** 128; **BB:** 139 as *Acrothecium penniseti* Mitra). On leaves and ears of *Pennisetum typhoides,* Pusa]

CYATHUS Haller ex Pers. (**Sacc. VII:** 32) Basidio., Nidulariales.

C. colensoi Berk. (**11:** 129; **Sacc. VII:** 156). On the ground, in a forest with thick undergrowth, Simla (7000 ft.).

C. montagnei Tul. (**5:** 291; **Sacc. VII:** 34). On old baskets, Dehra Dun.

C. striatus Willd. (**23:** 194; **Sacc. VII:** 33 gives *C. striatus* (Huds.) Hoffm.). On dead bamboo, Calcutta.

CYLINDROCLADIUM Morgan (**Sacc. XI:** 600) Imp., Moniliales (3B).

C. scoparium Morgan (**89:** 219-21; **Sacc. XI:** 600). On leaves of *Ficus carica,* Kanpur.

CYLINDROSPORIUM "Unger" (**Sacc. III:** 737) Imp., Melanconiales (E).

C. dichanthii Ramakr. T. S. & K. (**157:** 77). On leaves of *Dichanthium annulatum,* Coimbatore.

C. hamatum Bresadola (**115:** 26; **Sacc. XI:** 582). On leaves of *Heracleum* sp., Harwan (Kashmir).

C. koenigii Thirum. (**209:** 177). On *Murraya koenigii,* Bangalore.

C. mappiae Thirum. & Naras. (**217:** 69). On leaves of *Mappia foetida,* Kemmangudi, Mysore.

CYSTOPUS Lév. (**Sacc. VII:** 233) Phyco., Peronosporales (1).

C. evolvuli Damle (**48:** 135). On leaves and shoots of *Evolvulus alsinoides,* Poona.

C. intermediatus Damle (**49:** 45). On shoots and inflorescence of *Cardamine trichocarpa* (as *C. subumbellata*), Lonavala (Bombay).

C. molluginicola Ramakr. T. S. & K. (**158:** 97). On leaves and peduncles of *Mollugo nudicaulis,* Coimbatore, Madras.

CYTIDIA Quel. (**Sacc. XXIII:** 523) Basidio., Thelephoraceae.

[**C. habgallae** (Berk. & Br.) Martin. (**84:** 160; **Sacc. VI:** 641; **BB:** 113 as *Peniophora habgallae* (Berk. & Br.) Cooke.) Madura, India.]

DACRYOMITRA Tul. (**Sacc. VI:** 811) Basidio., Tremellales (3).

D. glossoides (Pers.) Bref. (**22:** 57; **Sacc. VI:** 811 as *D. glossoides* Bref.). On a fallen branch, Calcutta.

DACRYOPINAX Martin in *Lloydia* 11: 116. 1948. Basidio., Tremellales.

[**D. spathularia** (Schw.) Martin (**86:** 116; **Sacc. VI:** 807, **BB:** 98, **23:** 194 as *Guepinia spathularia* (Schw.) Fr.). On old wood, Calcutta; on dead bamboo, Calcutta.]

DAEDALEA Pers. ex Fr. (**Sacc. VI:** 370) Basidio., Polyporaceae.

D. stereoides Fr. (**31:** 76; **30:** 157; **Sacc. VI:** 379). Growing on logs, Sinchal, Darjeeling.

[**D. subferruginea** (Berk.) Cunningham (**46:** 243; **Sacc. V:** 643, **BB:** 107 as *Lenzites subferruginea* Berk.). On dead wood, Moflong, Khasi Hills.]

DALDINIA Ces. & de Not. (**Sacc. I:** 393 as *Daldinia* de Not. & Ces.) Asco. Sphaeriales (A2).

[**D. concentrica** (Bolt. ex Fr.) Ces. & de Not. (**127:** 2; **Sacc. I:** 393; **BB:** 20). On rotten wood of a deciduous tree, near Aru, Kashmir (8300 ft.). According to Padwick & Merh (**127:** 2) this is the first authentic record of this species in India. See also **M:** 13 under *D. eschscholzii*.]

DARLUCA Cast. (**Sacc. III:** 410) Imp., Sphaeropsidales (1B1).

D. genistalis (Fr.) Sacc. (**36:** 106; **Sacc. III:** 410). On uredia of *Puccinia cynodontis* on *Cynodon plectostachyum*. Botanical area, Indian Agr. Res., Inst., Delhi.

DASTURELLA Mundkur & Kheswalla in *Mycologia* 35: 202. 1943. Basidio., Uredinales.

D. bambusina Mundkur & Kheswalla (**112:** 203; **131:** 145). On leaves of *Bambusa* sp., Mahableshwar (Bombay).

[**D. divina** (Syd.) Mundkur & Kheswalla (**112:** 203; **229:** 371-79; **153:** 68; **M:** 20 as *Angiopsora divina* Syd.). On leaves of *Dendrocalamus strictus*, Lansdowne (U.P.), Saharanpur; on *Dendrocalamus* sp. (nec *Bambusa* sp.), Majhgawan. Aecidial stage on leaves of *Randia brandisii* and *R. candolleana* from Walayar (Malabar) and Chittoor respectively (**153:** 68). By inoculation, uredia and telia on *Dendrocalamus strictus*, pycnia and aecia on *Randia dumetorum* (**229:** 371-79).]

DASYSCYPHELLA Tranz. (**Sacc. XIX:** 551) Asco., Helotiales (= *Lachnum* fide Nannfeldt).

D. indica Cash (**33:** 724). On mossy bark of trees, Mussoorie.

DICTYONELLA Hoehnel (**Sacc. XXII:** 583) Asco., Myriangiales (2).

D. alangii Hansf. & Thirum. (**61:** 285). On leaves of *Alangium begoniifolium*, Thirthahalli, Mysore.

DIDERMA Pers. (**Sacc. VII:** 374) Myxomycetes, Physarales, Didymiaceae.

[**D. luteo-album** (List.) Buchet (**RS:** 206; **M:** 6 as *Physarum luteo-album* Lister). N. W. India.]

DIDYMOPSORA Diet. (**Sacc. XVI:** 315 as *Didymopsora* Diet. et Hedw.) Basidio., Uredinales (2).

D. macrospora Mundkur & Thirum., see *Didymopsorella macrospora*.

D. toddaliae Thirum & Mundkur, see *Didymopsorella toddaliae*.

DIDYMOPSORELLA Thirum. in *Sci. Cult.*, 16: 210. 1950. Basidio., Uredinales.

D. macrospora (Mundkur & Thirum.) Thirum. (**219:** 210-11; **193:** 171 as *Didymopsora macrospora*). On leaves of *Toddalia asiatica* v. *gracilis* (as *T. aculeata* v. *gracilis*), Balehonnur, Mysore.

D. toddaliae (Petch) Thirum. (**219:** 210; **193:** 170 as *Didymopsora toddaliae* Thirum & Mundkur). On leaves of *Toddalia asiatica* v. *gracilis* and v.

floribunda (as *T. aculeata* v. *gracilis* and v. *floribunda*), Yeshwantpur, Bangalore, Mysore.

DIMERIELLA Speg. (**Sacc. XXII**: 37) Asco., Erysiphales (2).

D. salaciae Hansf. & Thirum. (**61**: 300). On leaves of *Salacia* sp., Balehonnur, Mysore.

DIPLODIA Fr. (**Sacc. III**: 329) Imp., Sphaeropaidales (1B2).

D. cajani Raychaudhuri (**168**: 844). On living and dead stems of *Cajanus cajan*, Pusa (Bihar).

D. epicoccos Cooke (**131**: 126; **Sacc. III**: 372). On fronds and fruits of *Cocos nucifera*, Bombay State.

D. longipedicellata Ramakr. T. S. & K. (**157**: 78). On leaves of *Syzigium montanum*, Ootacamund.

D. profusa de Not. (**36**: 112; **Sacc. III**: 336). On dead twigs of *Robinia pseudo-acacia*, Flowerdale, Simla.

DISCELLA Berk. & Br. (**Sacc. III**: 687) Imp., Sphaeropsidales (4B).

D. cedrelae Ramakr. T. S. & K. (**158**: 110). On leaves of *Cedrela toona*, Sims Park, Coonoor, Nilgiris.

DISCISEDA Czern. (**Sacc. XVII**: 232) Basidio., Lycoperdales.

D. cervina (Berk.) Cunningham (**2**: 171). Hypogeous in sandy soil.

D. pedicellata (Morgan) Hollos (**11**: 129). Hypogeal, in rich humus under thick growth of *Acacia arabica* on the sides of a pond, Rohtak (E. Punjab).

DISCOSIA Lib. (**Sacc. III**: 653). Imp., Sphaeropsidales (3C).

D. himalayensis Died. (**124**: 11; **Sacc. XXV**: 517). On dead fallen leaves of *Quercus* sp., Nainital (U.P.). Incorrectly listed as *Dothiorella himalayensis* Died. in **BB**: 156.

DOASSANSIA Cornu (**Sacc. VII**: 502) Basidio., Ustilaginales (2).

D. hygrophilae Thirum. (**202**: 29; **204**: 603; **158**: 102). On leaves of *Hygrophila* sp., Mysore; of *Asteracantha longifolia*, Walayar (Malabar).

D. opaca Setchell (**216**: 178; **Sacc. XI**: 236). On leaves of *Sagittaria* sp., Closepet, Mysore.

DOASSANSIOPSIS (Setch.) Diet. (**Sacc. XX**: 626) Basidio., Ustilaginales (2).

[**D. martianoffiana** (Thuem.) Diet. (**100**: 316; **204**: 603; **Sacc. VII**: 504, **BB**: 44 as *Doassansia martianoffiana* (Thuem.) Schroet.). On floating leaves of *Potamogeton* sp., Wular Lake, Kashmir.]

[**D. nymphaeae** (Syd.) Thirum. (**204**: 604; **Sacc. XXIII**: 630, **BB**: 44 as *Doassansia nymphaeae* Syd.). On leaves of *Nymphaea stellata*, near Bassein (Bombay).]

DONKELLA Doty in *Lloydia* **13**: 14. 1950. Basidio., Agaricales.

D. corniculata (Fr.) Doty, see under *Clavulinopsis corniculata*.

ELSINOE Racib. (**Sacc. XVI**: 804) Asco., Myriangiales (2).

E. bitancourtiana Thirum. (*Mycologia*, 38: 223, 1946). on *scutia myrtina*, Mysore.

E. mezoneuri Ramakr. T. S. & K. (**157**: 70). On leaves of *Mezoneurum cucculatum*, Anamalais.

EMERICELLA Berk. (**Sacc. VII**: 154) Asco., Eurotiales (= *Eurotium*).

E. medias Chowdhury & Matthur, see *Aspergillus variecolor*.

EMPUSA Cohn (**Sacc. VII**: 281) Phyco., Entomophthorales (3).

E. aphidis Hoffman (**146**: 63). On aphids (*Macrosiphon solanifolii*?), Nanjanad, Nilgiris.

E. bitancourtiana Thirum.

E. grylli (Fres.) Nowakowski (**115**: 1; **Sacc. VII**: 282) Attacking and killing grasshoppers, Kodaikanal (Madras), Bangalore.

ENDOPHYLLUM Lév. (**Sacc. VII**: 767) Basidio., Uredinales (2).

E. heliotropii Thirum. & Naras. (228: 119). On *Heliotropium indicum*, Sreerangapatna, Mysore.

E. tuberculatum (Ell. & Kellerm.) Arth. & Fromme (44: 448; **Sacc. XXIII**: 849). On *Lavatera kashmiriana*, below Minimarg, Kishenganga Valley.

ENDOTHIA Fr. (**Sacc. I**: 601) Asco., Sphaeriales (B1).

E. parasitica (Murr.) And. & And. (58: 13-14; **Sacc. XXIV**: 761). On chestnuts, Chaubattia, Kumaon Hills.

ENDOTHIELLA Sacc. (**Sacc. XXII**: 965) Imp., Sphaeropsidales (1A1).

E. robiniae Chona & Munjal (36: 106). On dead twigs of *Robinia pseudo-acacia*, Flowerdale, Simla.

ENTOPHLYCTIS A. Fischer (**Sacc. XI**: 249) Phyco., Chytridiales (4).

E. bulligera (Zopf) Fischer (69: 134; **Sacc. XI**: 249). On *Spirogyra* sp., Jalla, Patna.

ENTYLOMA de Bary (**Sacc. VII**: 487) Basidio., Ustilaginales (2).

E. bidentis P. Henn. (148: 180; **Sacc. XIV**: 424). On *Bidens pilosa*, Coimbatore, Kallar (Coimbatore).

E. dactylidis (Pass.) Ciferri (165: 216). On *Dactylis glomerata*, Ootacamund.

E. dahliae Syd. (**100**: 332; **124**: 8; 148: 182; **Sacc. XXIII**: 624). On *Dahlia cocinea*, Victoria Gardens, Bombay; *D.* sp., Mussoorie, Nainital (U. P.); *D. variabilis*, Ootacamund, Nilgiris.

E. fuscum Schroet. (**158**: 102; **Sacc. VII**: 488). On leaves of *Papaver* sp., Ootacamund, Nilgiris.

E. irregulare Johans. (**146a**: 162; **Sacc. VII**: 490). On living leaves of *Poa annua*, Ootacamund.

E. mysorense Thirum. (**216**: 177). On stems of *Scirpus* sp., Anandapuram, Sagar.

E. scirpicola Thirum. & Dickson (222: 404). On leaves of *Scirpus articulatus*, Uttarahalli, Bangalore.

EREMASCUS Eidam (**Sacc. VIII**: 822) Asco., Endomycetales (2).

E. terrestris Asthana & Mahmud (**12**: 286, without diagnosis). In a betelvine garden, (? Nagpur).

ERYSIPHE Hedw. f. ex Fr. (Sacc. I: 15) Asco., Erysiphales (1).

E. horridula (Wallr.) Lév. (185: 442); **Sacc. I**: 17). On leaves of *Eritrichum rupestris*, Losar, spiti.

EUDARLUCA Speg. (**Sacc. XXII**: 201) Asco. Sphaeriales (B1).

E. indica Ramakr. (**146a**: 159) on uredia of *Uredo amomi* Petch, Anamalais.

EXOBASIDIUM Woron. (**Sacc. VI**: 664) Basidio., Exobasidiaceae.

E. celtidis Ramakr. T. S. & K. (155: 9). On leaves of *Celtis tetrandra*, Ootacamund (Nilgiris), Singampatti (Tinnevelly Dt.).

E. nilagiricum Ramakr. T. S. & K. (155: 7). On leaves *Gordonia obtusa*, Naduvattam & Coonoor (Nilgiris).

E. triseptatum Ramakr. T. S. & K. (155: 10). On leaves and stems of *Vaccinium leschnaultii*, Ootacamund.

E. vaccinii (Fuck.) Wor. (**155**: 6; **146**: 68; **Sacc. VI**: 664). On leaves and twigs of *Vaccinium neilgherrense*, Naduvattam and Coonoor (Nilgiris), Chinnakallar (Anamalais); On leaves of *Azalea indica*, Ootacamund.

FARYSIA Racib. (**Sacc. XXI**: 527). Basidio., Ustilaginales (1).

F. americana Ciferri (**135**: 109; **216**: 174). On *Carex baccans*, Kodaikanal; in ovaries of *Carex filicina*, Kemmangudi, Mysore.

F.caricis-filicinae S. Ito (**216**: 174). On *Carex condensata,* Khasi Hills.

F. olivacea (DC.) Syd. (215: 166; Sacc. **XXIII**: 631). Stated to occur in India.

F. orientalis Ling (**72**: 130). On *Carex baccans,* Ootacamund.

[**F. pseudocyperi** (de Toni) Zundel (**100**: 320; **BB**: 49 as *Ustilago endotricha* Berk.; Sacc. **XXIII**: 631 as *Farysia endotricha* (Berk.) Syd.). On *Carex condensata* (not "*baccans*"), Khasi Hills.]

FOMES (Fr.) Kickx (Sacc. **VI**: 150 gives "*Fomes* Fr.") Basidio., Polyporaceae.

F. caryophylli (Rac.) Bres. (**15**: 218; **30**: 154). On *Shorea robusta, Anogeissus latifolia, Cleistanthus collinus, Syzigium cumini, Madhuca latifolia,* India.

F. durus (Jungh.) Cunningham (**46**: 224; Sacc. **VI**: 147, **M**: 27 as *Polyporus durus* Jungh.). Lokra Hills, Assam.

[**F. scruposus** (Fr.) Cunningham (**46**: 241; Sacc. **VI**: 121, **BB**: 119 as *Polyporus scruposus* Fr.) On dead tree trunks.]

FOMITOPSIS Karsten (Sacc. **XIV**: 10) Basidio., Agaricales (= *Fomes* fide Murrill).

[**F. ochroleuca** (Berk.) Cunningham (**46**: 234; Sacc. **VI**: 145, **BB**: 117 as *Polyporus ochroleucus*). On dead wood, Calcutta.]

FRACCHIAEA Sacc. (Sacc. **I**: 93) Asco., Sphaeriales (AA).

F. heterogenea Sacc. (**110**: 3; Sacc. **I**: 93). On dead branches of *Mangifera indica,* Rohtak (E. Punjab).

FUSARIELLA Sacc. (Sacc. **IV**: 395). Imp., Moniliales (4C).

[**F. concinna** (Syd.) Hughes (**62**: 7-8; **M**: 33 as *Clasterosporium concinnum Syd.*) On *Ficus religiosa,* Allahabad.]

FUSARIUM Link ex Fr. (Sacc. **IV**: 694) Imp., Moniliales (6C1).

F. avenaceum (Fr.) Sacc. (**184**: 561; Sacc. **IV**: 713). Isolated from black cotton soil Udamalpet (Coimbatore).

F. biasolettianum Corda (**123**: 8; Sacc. **IV**: 725 as *Pionnotes biasolettiana*). On young shoots and slime-flux of *Cornus macrophylla,* Nainital (U. P.), 7000 ft.

F. brachygibbosum Padwick (**123**: 11). Isolated from diseased seedlings of *Sorghum vulgare,* Parbhani, Hyderabad Deccan.

F. chlamydosporum Wr. & Rg. (**184**: 561). Isolated from black cotton soil, Udamalpet (Coimbatore).

F. diversisporum Sherb. (**92**: 633; Sacc. **XXV**: 974). On petiole of a wilted leaf of *Carica papaya,* Allahabad.

F. equiseti (Corda) Sacc. (**123**: 9; **20**: 29-37; **184**: 561; Sacc. **IV**: 707). Isolated from rotten melon fruits, Delhi; On leaves of *Eichornia crassipes,* Calcutta; isolated from black cotton soil, Udamalpet (Coimbatore).

F. javanicum Koord. (**184**: 561; Sacc. **XXII**: 1482). Isolated from black cotton soil, Udamalpet (Coimbatore).

F. orthoceras App. & Wr. v. **callistephi** (Beach) Padwick (**121**: 283; **122**: 672; **131**: 149 as *F. conglutinans* Wr. v. *callistephi* Beach). On roots of *Callistephus chinensis,* Poona.

F. orthoceras App. & Wr. v. **ciceri** Padwick (**121**: 283; **122**: 672). Cause of vascular wilt of *Lathyrus sativus,* Broach Dt. (Bombay).

F. orthoceras App. & Wr. v. **lathyri** Bhide & Uppal (**25**: 565). Cause of vascular wilt of *Lathyrus sativus,* Broach Dt. (Bombay).

F. poae (Peck) Wr. (**123**: 13; **184**: 561; Sacc. **XVIII**: 525 as *Sporotrichum poae* Peck). Isolated from diseased stems and inflorescences of *Pennisetum typhoides* (Cultures sent by E. F. Vestal, Allahabad Agricultural College) isolated from black cotton soil, Udamalpet (Coimbatore).

F. scirpi Lamb. & Fautr. (184: 561; Sacc. XI: 651). Isolated from black cotton soil, Udamalpet (Coimbatore).

F. scirpi Lamb. & Fautr. v. **acuminatum** (Ell. & Ev.) Wr. (184: 561; Sacc. XIV: 1125 as *F. acuminatum* Ell. & Ev.). Isolated from black cotton soil, Udamalpet (Coimbatore).

F. semitectum Berk. & Rav. (92: 633; Sacc. IV: 718). On fruits of *Citrus medica*, Allahabad.

F. semitectum Berk. & Rav. v. **majus** Wr. (92: 632). Isolated from darkened young shoot of *Aegle marmelos*, Allahabad.

F. solani (Mart.) App. & Wr. v. **martii** (App. & Wr.) Wr. (184: 561; Sacc. XXII: 1477 as *F. martii* App. & Wr.). Isolated from black cotton soil, Udamalpet (Coimbatore).

F. solani (Mart.) App. & Wr. v. **minus** Wr. (123: 11; 184: 561; Sacc. XXV: 978). Isolated from rotten potato tubers still attached to the parent plants, Simla; isolated from black cotton soil, Udamalpet (Coimbatore).

F. solani (Mart.) App. & Wr. v. **striatum** (Sherb.) Wr. (184: 561; Sacc. XXV: 978 as *F. striatum* Sherb.). Isolated from black cotton soil, Udamalpet (Coimbatore).

F. spinaciae Sherb. (175: 104, without authority). On *Spinacia oleracea*, Kanpur.

[**F. udum** Butler (32: 1-64; 122: 672; Sacc. XXII: 1479; BB: 146 as *F. vasinfectum* Atk., *F. uncinatum* Wr.; M: 34 as *F. lateritium* Nees v. *uncinatum* Wr.). Cause of wilt of *Cajanus cajan* in India.]

F. udum Butler v. a. **crotalariae** (Kulkarni) Padwick (122: 673). Cause of vascular wilt of *Crotalaria juncea* in India. Isolated from wilted plants of *C. medicaginea* v. *neglecta*, sent from Gwalior (123: 10).

GANODERMA Karst. (Sacc. IX: 176) Basidio., Polyporaceae.

[**G. annulare** (Lloyd) Boedijn (28: 391; BB: 94 as *Fomes annularis* Lloyd). On tree trunks, Darjeeling.]

GEASTER Mich. ex Fr. (Sacc. VII: 70) Basidio., Lycoperdales (≡ *Geastrum*).

G. mammosus Fr. (4: 176; Sacc. VII: 85). Solitary on the ground, Jalori Pass (10,000 ft.).

G. triplex Jungh. (4: 177; Sacc. VII: 74). Solitary on the ground, Khanag, Kulu Hills; Chamba; in Herb. Forest Res. Inst. as *G. saccatus* Fr.

GEASTRUM Pers. (Sacc. VII: 70 gives *Geastrum* Pers. under *Geaster* Mich). Basidio., Lycoperdales.

G. clelandi (Lloyd) Cunningham (RS: 99; 4: 176 as *Geaster clelandii* Lloyd). Solitary on the ground. Jalori Pass, 10,000 ft.

G. minus (Pers.) Cunningham (2: 172). Solitary on the ground, epigeous, Gurdaspur (E. Punjab).

G. simulans (Lloyd) Cunningham (RS: 100; 4: 176, Sacc. XXI: 478 as *Geaster simulans* Lloyd). Solitary on the ground, Rotang Pass, 16,000 ft.

GEOGLOSSUM Pers. ex Fr. (Sacc. VIII: 42) Asco., Helotiales (1).

G. velutipes Peck (9: 11; Sacc. VIII: 46). On the ground in an oak forest, Murree.

GLOEOSPORIUM Desm. & Mont. (Sacc. III: 699) Imp., Melanconiales (A1).

G. anthocephali Lal & Tandon (71: 144). On leaves, stems and fruits of *Anthocephalus cadamba*, Benares, Allahabad, Dehra Dun.

G. artocarpi Delacr. (158: 98 as *Glomerella artocarpi* Delacr.; Sacc. XVIII: 454). On leaves of *Artocarpus integrifolia*, Thondamuthur (Coimbatore).

G. zonatum Ramakr. T. S. & K. (158: 108). On leaves of *Coelogyne* sp., Ambillimalai estates, Gudalur, Nilgiris.

GLOMERELLA Schrenk & Spaulding (Sacc. **XXIV**: 793) Asco., Sphaeriales (A1).

G. artocarpi Delacr., see *Gloeosporium artocarpi.*

G. **major** Tunstall & Sarmah (RS: 241; Mem. Tocklai Exp. Sta., 16: 73, 1947). On *Thea sinensis*, India. But see *G. major* Tunstall, *Trans. Brit. mycol. Soc.* 19: 332. 1935).

GLONIUM Muhlenb. ex Fr. (Sacc. II: 731) Asco., Hysteriales.

G. **lineare** (Fr.) de Not. (9: 11; Sacc. II: 732). On dead wood, Murree.

GOPLANA Racib. (Sacc. XVI: 318) Basidio., Uredinales (2).

G. **indica** Ramakr. T. S. & K. (156: 48). On leaves of *Beilschmedia roxburghiana*, Chinnakallar (Anamalais).

GUIGNARDIA Viala & Ravaz (Sacc. XXII: 72) Asco., Sphaeriales (A1).

G. **nilagirica** Ramakr. T. S. & K. (153: 56; 146a: 161). On leaves of papilionaceous plant, Kallar (Coimbatore); on living leaves of *Derris scandens*, Walayar (Malabar).

GYMNOPUCCINIA Ramakr. in *Trans Brit. mycol. Soc.*. 31: 141; 1951. Basidio., Uredinales (2). Thirumalachar & Mundkur (224: 204) state: "The recently published genus *Gymnopuccinia* Ramakrishnan is undoubtedly a synonym of this genus", i.e., *Didymopsorella* Thirum.

G. **pulneyensis** Ramakr. (145: 141). On living leaves and stems of *Toddalia asiatica*, Kodaikanal.

GYMNOSPORANGIUM Hedw. f. (Sacc. VII: 737) Basidio., Uredinales (2).

G. **clavariaeforme** (Jacq.) DC. (44: 448; Sacc. VII: 737 gives *G. clavariaeforme* (Jacq.) Rees). On leaves and fruits of *Cotoneaster integerrima*, above Rattu, Gilgit Road; Godai to Chillam, Gilgit Road; on *C. nummularia*, Chorwan; Rattu, above Astor Valley; Rupal Nullah, Nanga Parbat.

G. **confusum** Plowr. (44: 449; Sacc. XVII: 462). On *Crataegus oxyacantha*, Rupal Nullah; Badwan, Kishenganga Valley; on *Pyrus lanata*, Chorwan; *Juniperus macropoda*, Chorwan. Note: identity of telial collections, however, doubted by Cummins 44: 449).

HAMIDIA Chaudhuri in *Proc. Indian Acad. Sci.*, B, 15: 227. 1942. Phyco., Saprolegniales.

H. **indica** Chaudhuri (34: 227). In samples of water with decaying twigs from Tarn Taran (Amritsar Dt.), Barhamjit (Hoshiarpur Dt.), E. Punjab.

HAPALOPHRAGMIOPSIS Thirum. in *Mycologia* 42: 227. 1950. Basidio., Uredinales (2).

[H. **ponderosa** (Syd. & Butler) Thirum. (218: 227; Sacc. XXIII: 788, BB: 59 as *Hapalophragmium ponderosum* Syd. & Butler; 242: 239 as *Triphragmium ponderosum* (Syd. & Butler) Venkatarayan). On twigs of *Acacia leucophloea* Poona; Salem; Coimbatore; Allahabad.]

HAPALOPHRAGMIUM Syd. (Sacc. XVI: 1121) Basidio., Uredinales (2).

H. **anamalaiensis** Ramakr. T. S. & K. (152: 41). On leaves of *Derris cualata*, Anamalais.

H. **mysorense** Thirum. (218: 224). On leaves of *Derris benthamii*, Kemmangudi, Mysore.

HAPLORAVENELIA H. Syd. in *Ann. mycol., Berl.*, 19: 165. 1921. Basidio., Uredinales (2).

[H. **hobsoni** (Cooke) Ito (RS: 2: 39; Sacc. VII: 772, BB: 76 as *Ravenelia hobsoni* Cooke). On leaves of *Pongamia glabra*, Calcutta, Madras, Bombay]

HARIOTULA Arnaud (**Sacc. XXIV**: 487) Asco. Hemisphaeriales (= *Asterinella* fide Stevens & Ryan).

H. capparidis Hansf. & Thirum. (**61**: 302). On leaves of *Capparis sepiaria*, Nandi, Mysore.

H. convolvuli Hansf. & Thirum. (**61**: 302). On leaves of *Convolvulus* sp., Bangalore.

HELICOCERAS Linder in *Ann. Mo. bot. Gard.*, **18**: 2. 1931. Imp., Moniliales (4C).

H. oryzae Linder & Tullis (**129**: 212). On dead wood of *Cassia sumatrana*, Lucknow.

HELMINTHOSPORIUM Link ex Fr. (**Sacc. IV**: 402) Imp., Moniliales (4C).

H. albizzicolum Thirum. & Naras. (**217**: 67). On leaves of *Albizzia lebbeck*, Tirupati (Madras).

H. atro-olivaceum Cooke & Harkn. (**170**: 333-34; **Sacc. IV**: 409). On fruits of *Nephelium litchi*, *Psidium guajava* and *Zizyphus jujuba*, Calcutta.

H. erythrinae Thirum. & Naras. (**217**: 68). On leaves of *Erythrina suberosa*, Kemmangudi, Mysore.

H. ravenelii Curtis & Berk. (**186**: 446; **217**: 69; **Sacc. IV**: 412). In spikes of *Oropetium thomaeum*, Jaggaipur (E. Punjab); on spikelets of *Eragrostis pilosa*, Nandi Hills, Mysore.

H. torulosum (Syd.) Ashby (**94**: 103-104; **Sacc. XXII**: 1395 as *Brachysporium torulosum* Syd.). On bananas, Madhya Pradesh.

H. wagateae Thirum. & Naras. (**217**: 69). On leaves of *Wagatea spicata*, Balehonnur, Mysore.

HELVELLA L. ex Fr. (**Sacc. VIII**: 17) Asco., Pezizales (3).

H. ephippium Lév. (**9**: 11; **Sacc. VIII**: 28). On the ground, Murree.

H. fusca Gill. (**9**: 11; **Sacc. VIII**: 20). On the ground, Murree.

HEMILEIA Berk. & Br. (**Sacc. VII**: 585) Basidio., Uredinales (2).

H. gardeniae-thunbergiae Maubl. & Roger (**226**: 82). On leaves of *Gardenia latifolia*, Balehonnur (Bangalore); Burudalbore, Hassan, Mysore. **BB**: 59 gives the fungus on *Gardenia* under *H. vastatrix*.

H. jasmini Krishnam. & Rang. (**68**: 31). On leaves of *Jasminum ritchii*, Yercaud (Salem).

H. mysorensis Thirum. & Goplakr. (**203**: 232). On leaves of *Gymnema* sp., Balehonnur, Mysore.

H. thomasii Thirum. & Naras. (**226**: 85). On leaves of *Randia uliginosa*, Nallur, Shimoga (Mysore); Siddapur (Coorg). This rust was doubtfully recorded as *H. woodii* in **BB**: 59.

H. wrightiae Racib. (**161**: 256; **203**: 231). On leaves of *Wrightia tinctoria*, Walayar (Malabar); Bangalore; on *W. tomentosa*, Kallar (Coimbatore).

HETEROSPORIUM Klotzsch ex Cooke (**Sacc. IV**: 480) Imp., Moniliales (4C).

H. echinulatum (Berk.) Cooke (**146**: 69; **Sacc. IV**: 481). On leaves of *Dianthus caryophyllus*, Ootacamund.

H. interseminatum (Berk. & Rav.) Atk. (**42**: 621; **170**: 333 as *Dendryphiella interseminata*; **Sacc. IV**: 407 as *Helminthosporium interseminatum* Berk. & Rav.). On fruits of *Zizyphus jujuba*, Calcutta.

H. variabile Cooke (**123**: 15; Sacc. **IV**: 480). On leaves of *Spinacia oleracea*, Srinagar, Kashmir.

HUMARIA (Fr.) Sacc. (**Sacc. VIII**: 118 cites *Humaria* Fr.) Asco., Pezizales. Ainsworth & Bisby (Dictionary, 1945) mention: *Humaria* (Fr.) Sacc =

Humarina Seaver fide Seaver; *Humaria* Fuckel = *Patella* Weber ex Morgan.

H. pallidisetosa Cash (33: 725). On the ground, Rohtak (E. Punjab).

H. pulcherrima (Crouan) Speg. (9: 11). On cowdung, Rohtak (E. Punjab).

HYALOPSORA Magn. (Sacc. XVII: 268) Basidio., Uredinales (1).

H. polypodii P. Magn. (185: 442; Sacc. XVII: 268). On leaves of *Cystopteris fragilis*, Rotang Pass.

HYDNELLUM Karst. (Sacc. XIV: 210) Basidio., Hydnaceae. (segregate from *Hydnum*).

H. zonatum (Batsch) Karst. forma **vespertilio** (Berk.) Coker & Beers (RS 2: 39; Sacc. VI: 442, BB: 102 as *Hydnum vespertilio* Berk.). On the ground, Nucklow, Khasi Hills.

HYPOCREA Fr. (Sacc. II: 520) Asco., Hypocreales (B1).

H. citrina (Pers. ex Fr.) Fr. (123: 2; 9: 11 as *H. citrina* (Pers.) Winter; Sacc. II: 528). On a dead tree stump and spreading on to neighbouring living plants, Nainital (U. P.); on dead branches and covering large portions of a rock, Murree.

HYPOMYCES (Fr.) Tul. (Sacc. II: 466) Asco., Hypocreales (B1).

H. haematococcus (Berk. & Br.) Wr. (14: 332; Sacc. II: 496 as *Nectria haematococca* Berk. & Br.). On bark of *Tectona grandis*, Dehra Dun.

HYSTEROSTOMA Theiss. (Sacc. XXIV: 412) Asco., Hemisphaeriales (1).

H. brevilobi Ramakr. (146: 65). On leaves of *Jasminum brevilobum*, Kodaikanal.

H. pavettae Ramakr. T. S. & K. (152: 36). On leaves of *Pavetta indica*, Kallar-Burliar (Coimbatore).

IRENINA Stev. in *Ann. mycol.*, Berl., 25: 411. 1927. Asco., Erysiphales (2).

I. malloti Hansf. & Thirum. (61: 289). On leaves of *Mallotus alba*, Balehonnur, Mysore.

I. pothodis Hansf. & Thirum. (61: 288). On leaves of *Pothos scandens*, Thirthahalli, Mysore.

IRENOPSIS Stev. in *Ann. mycol.*, Berl., 25: 411. 1927. Asco., Erysiphales (2).

I. mysorensis Hansf. & Thirum. (61: 288). On leaves of *Lasiosiphon eriocephalum*, Ranjatakatte, Thirthahalli, Mysore.

IRPEX Fr. (Sacc. VI: 482) Basidio., Hydnaceae or Polyporaceae.

I. destruens Petch (233: 23; Sacc. XXI: 376). On tea, Assam.

I. subvinosus Berk. & Br. (233: 23). On tea, Assam.

ISOACHLYA Kauffman in *Amer. J. Bot.*, 8: 231. 1921. Phyco., Saprolegniales (1).

I. anisospora (de Bary) Coker v. **indica** Saksena & Bhargava (171: 79). In a pond, Allahabad.

ITAJAHYA Moeller (Sacc. XI: 153). Basidio., Phallales.

I. rosea (Delile) Fischer (6: 239; 2: 174, Sacc. XI: 154 as *I. galericulata* Moeller). Common in Punjab plains and also at Rohtak (E. Punjab); solitary or in groups on decaying vegetable debris under trees of *Salvadora oleoides* and *Capparis aphylla*.

ITHYPHALLUS (Fr.) Fischer (Sacc. VII: 8 as *Ithyphallus* Fr.) Basidio., Phallales. (= *Phallus* fide Fischer).

I. rubicundus (Bosc.) Fischer (2: 173; Sacc. VII: 11). Solitary or in groups on the ground.

KELLERMANNIA Ell. & Ev. (**Sacc. X**: 337) Imp., Sphaeropsidales (1B1).

K. malabarica Ramakr. T. S. & K. (**159**: 211). On leaves of *Anogeissus latifolia*, Walayar (Malabar).

KERNELLA Thirum. in *Mycologia*, **41**: 97. 1949. Basidio., Uredinales (2).

K. lauricola (Thirum.) Thirum. (**214**: 97; **201**: 685, **149**: 9 as *Kernia lauricola* Thirum.). On leaves of *Litsea* sp., Sontikoppa Road, Mercara, Coorg; on *Phoebe paniculata* and *P. wightii*, Ootacamund, Coonoor, Naduvattam.

KERNIA Thirum. ≡ *Kernella* Thirum.

K. lauricola Thirum., see *Kernella lauricola*.

LACELLINA Sacc. (**Sacc. XXV**: 781) Imp., Moniliales (4A).

L. libyca Sacc. & Trott. (**9**: 15: **Sacc. XXV**: 781). On dead culms and leaves of Gramineae, esp., *Saccharum munja* and *S. spontaneum*, Rohtak (E. Punjab).

LACHNOCLADIUM Lév. (**Sacc. VI**: 738) Basidio., Clavariaceae.

L. brasiliense Lév. (**22**: 41; **Sacc. VI**: 738). On earth and decaying leaves, Calcutta.

L. ornatipes (Peck) Burt (**22**: 41). Among decaying leaves by the side of a pond, Calcutta.

LAGENIDIUM Schenk (**Sacc. VII**: 278) Phyco., Lagenidiales.

L. entophytum (Pringsh.) Zopf (**69**: 134). On *Spirogyra* sp., Jalla, Patna.

LAMPROSPORA de Not. (**Sacc. XXIV**: 1169) Asco., Pezizales (2).

L. constellatis (Berk. & Br.) Seaver (**9**: 11). On the ground, Rohtak, E. Punjab.

LENTINUS Fr. (**Sacc. V**: 571) Basidio., Agaricaceae.

L. decaisneanus Lév. (**22**: 43, without authority; **Sacc. V**: 610). On dead tree of *Cocos nucifera*, Calcutta.

LENZITES Fr. (**Sacc. V**: 637) Basidio., Agaricales.

[**L. tenuis** (Berk.) Cunningham (**46**: 244; **Sacc. VI**: 376, **BB**: 92 as *Daedalea tenuis* Berk.). On dead wood, Parasnath, and Khasi Hills.]

[**L. unicolor** (Fr.) Cunningham (**46**: 246; **Sacc. VI**: 377, **BB**: 92 as *Daedalea unicolor* (Bull.) Fr.). On prostrate trunks and stumps, Darjeeling.]

LEPIOTOPHYLLUM Locquin in *Bull. mens. Soc. Linn. Lyon*, **11**: 42. 1942. (**RS**: 57). Basidio., Agaricales.

[**L. badhamii** (Berk. & Br.) Locquin (**RS**: 57; **Sacc. V**: 35, **BB**: 107 as *Lepiota badhamii* Berk.).]

[**L. rhacodes** (Vittad.) Locquin v. **pullaris** (Fr.) Locquin (**RS**: 57; **Sacc. V**: 29, **BB**: 108 as *Lepiota rhacodes* Vittad. v. *puellaris* Fr.). On the ground, Kalsia Hills.]

LEPTOSPHAERIA Ces. & de Not. (**Sacc. II**: 13) Asco., Sphaeriales (C2).

L. capparidicola Mundkur & Ahmad (**110**: 4). On dead branches of *Capparis aphylla*, Rohtak, E. Punjab.

L. porellae Thirum. (**207**: 11). On thallus of *Porella* sp., Nandi Hills, Mysore.

L. swertiae Thirum. (**209**: 176). On leaves of *Swertia* sp., Kemmangudi, Mysore.

LEUCOAGARICUS (Locquin) Singer in *Sydowia*, **2**: 35. 1948. Basidio., Agaricales.

[**L. excoriatus** (Schaeff. ex Fr.) Singer (**RS**: 263; **Sacc. V**: 31, **BB**: 108 as *Lepiota excoriata*). On the ground, Darjeeling, etc.]

LINOSPORA Fuckel (**Sacc. II**: 354) Asco., Sphaeriales (E).

L. ochracea (Desm.) Sacc. (**110**: 4; **Sacc. II**: 355). On leaves of *Pyrus malus*. Chaubhatia (U. P.).

LYCOPERDON Pers. (**Sacc. VII:** 106 gives "*Lycoperdon* Tourn.") Basidio., Lycoperdales.

L. depressum Bon. (**2:** 170; **Sacc. VII:** 116). Solitary or gregarious on rotten manure heaps, Gurdaspur, E. Punjab.

L. mundkuri Ahmad (**5:** 286). On the ground, Khanag, Kulu, 8000 ft.

L. polymorphum Vitt. (**5:** 289; **Sacc. VII:** 110 under *L. furfuraceum* Schaeff.). On the ground, rich in humus, solitary or in groups, Mussoorie; Sonamarg, Kashmir.

[**L. trachysporum** (Lloyd) Ahmad (**5:** 285; **Sacc. XXI:** 483, **BB:** 134 as *Bovistella trachyspora*). Evidently in moss, Mussoorie.]

L. umbrinum Pers. (**5:** 284; **Sacc. VII:** 116 under *L. hirtum* Mart.). Solitary on the ground, Khanag, Kulu.

L. wrightii Berk. & Curt. (**5:** 287; **Sacc. VII:** 111). In grassy places, Mussoorie, 7000 ft.

MACROLEPIOTA Singer in *Pap. Mich. Acad. Sci.*, **32:** 141. 1946. Basidio., Agaricales.

[**M. procera** (Scop. ex Fr.) Singer (**RS:** 243; **Sacc. V:** 27 as *L. procera* Scop.; **BB:** 108 as *Lepiota procera* (Scop.) Sacc.). On the ground under *Ficus carica*, Saharanpur.]

MACROPHOMA (Sacc.) Berl. & Vogl.? (**Sacc. X:** 189). Imp., Sphaeropsidales (= *Botryodiplodia*).

M. rotalae Thirum. & Naras. (**217:** 71). On leaves of *Rotala aquatica*, Thirthahalli, Mysore.

MAINSIA Jackson in *Mycologia*, **23:** 106. 1931. Basidio., Uredinales (2).

M. pterocarpi Thirum., see *Maravalia pterocarpi*.

MARASMIELLUS Murrill (**Sacc. XXIII:** 162) Basidio., Agaricales.

[**M. ramealis** (Bull. ex Fr.) Singer (**RS:** 243; **Sacc. V:** 531, **BB:** 110 as *Marasmius ramealis* (Bull.) Fr.). On dead roots, Saharanpur.]

MARAVALIA Arthur in *Bot. Gaz.*, **73:** 60. 1922. Basidio., Uredinales (2).

[**M. ascotela** (Syd.) Mains (**82:** 678; **45:** 213; **213:** 339; **191:** 176 as *Chrysocelis ascotela* (Syd.) Thirum.; **151:** 67 as *Scopella ascotela* (Syd.) Ramakr. T. S. & K.; **M:** 20 as *Blastospora ascotela* Syd.). On leaves of *Oldenlandia stylosa* (as *Hedyotis stylosa* in **191:** 176), Kodaikanal, and Ootacamund; on *O. articularis*, Ootacamund.]

M. pterocarpi (Thirum.) Thirum. (**213:** 339; **203:** 234 as *Mainsia pterocarpi* Thirum.; **150:** 63 as *Scopellopsis dalbergiae* Ramakr. T. S. & K.). On leaves of *Pterocarpus marsupium*, Balehonnur,, Mysore; on stems and leaves of *Dalbergia paniculata*, Walayar (Malabar).

MASSARIA de Not. (**Sacc. II:** 2) Asco., Sphaeriales (2).

M. mori Miyake (**110:** 4; **Sacc. XXIV:** 1005). On dead twigs of *Morus alba*, Rohtak, E. Punjab.

MASSARINA Sacc. (**Sacc. II:** 153) Asco., Sphaeriales (C1).

M. graminicola Mundkur & Ahmad (**110:** 4). On dead runners of *Eleusine flagellifera*, Rohtak, E. Punjab; on *Sporobolus pallidus*, Rohtak, E. Punjab.

MASSEEELLA Diet. (**Sacc. XIV:** 292). Basidio., Uredinales (2).

M. breyniae Thirum. (**198:** 47; **230:** 201; **Sacc. XXI:** 780; **BB:** 52 as *Aecidium breyniae* Syd.). On leaves of *Breynia rhamnoides*, Nandi Hills, Mysore.

M. narasimhanii Thirum. (**197:** 39). On leaves of *Fluggea leucopyros*, Yeshwantpur, Mysore; New Delhi.

MEHTAMYCES Mundkur & Thirum. in *Mycologia,* 37: 620. 1945. Basidio., Uredinales (1).

M. stereospermi (Mundkur) Mundkur & Thirum. (114: 621; Sacc. XXIII: 919 as *Uredo stereospermi* Syd.; 103: 542 as *Phakopsora stereospermi* Mundkur). On living leaves of *Stereospermum suaveolens,* Nagpur. Although *Mehtamyces* has been listed as a synonym of *Phragmidiella* by Thirumalachar & Mundkur (223: 240), this fungus has not been formally transferred to *Phragmidiella.* See 223: 240-41.

MELAMPSORA Cast. (Sacc. VII: 586) Basidio., Uredinales (1).

M. larici-epitea Klebh. (44: 450; Sacc. XXIII: 836). On *Salix hastata,* below Kun Patthar; Burzil Chowki; Gilgit Road; on *S. oxycarpa,* Godai above Gurikot.

M. mundkuri Thirum. (189: 366, without diagnosis). On leaves of *Lobelia trigona,* Bangalore.

M. oblonga Bagchee (16: 57). On *Pinus excelsa,* Central Himalayas, U. P.

M. stereospermi Ramakr. T. S. & K. (156: 51). On leaves of *Stersospermum tetragonum,* Gudalur (Nilgiris), Walayar (Malabar); on *Stereospermum suaveolens,* Walayar (Malabar). Thirumalachar & Mundkur (223: 240-41) consider that this fungus is probably a stage in the life history of *Mehtamyces stereospermi.*

MELANOGASTER Corda (Sacc. VII: 164) Basidio., Hymenogastrales.

M. ambiguus (Vitt.) Tul. (4: 173; Sacc. VII: 165). Growing in groups, a few inches below the ground, Dalhousie, Chamba Road.

MELANOPSAMMA Niessl (Sacc. I: 575) Asco., Sphaeriales (B1).

M. ranjanii Mitra (93: 162). At the tips of branches and spikes of *Selaginella chrysocaulos,* Darjeeling.

MELANOPSICHIUM Beck (Sacc. XVII: 484). Basidio., Ustilaginales (1).

[**M. eleusinis** (Kulkarni) Mundkur & Thirum. (115: 1; 109: 110; BB: 49 as *Ustilago eleusinis* Kulkarni). On *Eleusine coracana,* Malkapur (Kolhapur), Bangalore.]

M. esculentum (P. Henn.) Mundkur & Thirum. (115: 2; 108: 49, Sacc. XI: 232 as *Ustilago esculenta* P. Henn.). On culms of *Zizania latifolia,* Logtak Lake, Imphal (Manipur).

[**M. pennsylvanicum** Hirschhorn (115: 2; BB: 45 as *M. austro-americanum*). On inflorescence causing hypertrophy of flowers and stems of *Polygonum glabrum,* Pusa (Bihar), Bangalore.]

MELANOTAENIUM de Bary (Sacc. VII: 496) Basidio., Ustilaginales (2).

M. brachiariae Viegas (148: 183; 115: 5 as *Tolyposporella brachiariae* Mundkur & Thirum.). On leaves and leaf sheaths of *Brachiaria distachya,* Coimbatore, Bangalore, New Delhi.

MELIOLA Fr. (Sacc. I: 60) Asco., Erysiphales (2).

M. bakeri Syd. (61: 289). On *Leea* sp., Kudumallige, Thirthahalli, Mysore; on *L. macrophylla,* Balehonnur, Mysore.

M. bambusicola Hansf. (60: 31). On *Bambusa* sp., Ooty, India.

M. bangalorensis Hansf. & Thirum. (61: 290). On leaves of *Ficus* sp., Bannerghatta, Bangalore, Mysore.

M. cansjerae Hansf. & Thirum. (61: 290). On leaves of *Cansjera rheedii,* Nandi Hills, Mysore.

M. cissampelicola Hansf. & Thirum. (61: 291). On leaves of *Cissampelos pareira* (as *C. convolvulacea*), Augumbe, Mysore.

M. dichapetali Hansf. & Thirum. (**61: 292**). On leaves of *Dichapetalum gelonioides*, Balehonnur, Mysore.

M. elaeagni Hansf. & Thirum. (**61: 292**). On leaves of *Elaeagnus conferta* (as *E. latifolia*), Balehonnur, Mysore, Bangalore.

M. ficicola Hansf. & Thirum. (**61: 293**). On leaves of *Ficus* sp., Balehonnur, Mysore.

M. gardneriae Hansf. & Thirum. (**61: 293**). On leaves of *Gardneria* sp., Balehonnur, Mysore.

M. heyniae Hansf. & Thirum. (**61: 294**). On leaves of *Heynea trijuga*, Korekote, Thirthahalli, Mysore.

M. holarrhenae Hansf. & Thirum. (**61: 295**). On leaves of *Holarrhena antidysenterica*, Balehonnur, Mysore.

M. ichnocarpi Hansf. & Thirum. (**61: 295**). On leaves of *Ichnocarpus frutescens*, Hirethola, Thirthahalli, Mysore. (But see *M. ichnocarpi* Stevens & Roldan, 1935).

M. kydiae-calycinae Hansf. & Thirum. (**61: 296**). On leaves of *Kydia calycina*, Augumbe, Mysore.

M. ovatipoda Hansf. & Thirum. (**61: 297**). On leaves of *Ficus* sp., Balehonnur, Mysore.

M. osyridicola Hansf. (**60: 34**). On leaves of *Osyris arborea*, Ooty.

M. ranganathii Hansf. (**60: 35**). On leaves of *Eugenia* sp., South Kanara, Bombay.

M. tabernaemontanicola Hansf. & Thirum. (**61: 298**). On leaves of *Tabernaemontana* sp., Balehonnur, Mysore.

M. tecleae Hansf. v. **toddaliae-asiaticae** Hansf. (**61: 298**). On leaves of *Toddalia asiatica* v. *floribunda*, Balehonnur, Mysore.

M. toddalicola Hansf. v. **indica** Hansf. & Thirum. (**61: 299**). On leaves of *Toddalia asiatica* v. *floribunda*, Balehonnur, Mysore.

M. zizyphi Hansf. & Thirum. (**61: 300**). On leaves of *Zizyphus rugosa*, Balehonnur, Mysore.

MEMNONIELLA Hoehnel in *Zbl. Bakt.* (2 Abt.), **60**, 1923, p. 16. Imp., Moniliales (4A).

M. echinata (Riv.) Gallow. (**123: 14**). Isolated from cotton cordage, Kanpur; isolated from soil, Vandalur (Madras).

MICROSTROMA Niessl (**Sacc. IV: 9**) Imp., Melanconiales (A1).

M. albizziae Syd. (**217: 70**; **Sacc. XXV: 634**). On leaves of *Albizzia odoratissima*, Nandi Hills, Mysore.

M. cadabae Thirum. & Naras. (**217: 70**). On leaves of *Cadaba indica* Channapatna, Mysore.

MITRULA Pers. ex Fr. (**Sacc. VIII: 32**). Asco., Helotiales (1).

M. agharkarii Banerji (**21: 309**). Soil, Senchal range, Darjeeling (8000 ft.), Sikkim Himalayas.

MONILIA Pers. ex Fr. (**Sacc. IV: 31**). Imp. Moniliales (3A).

M. sitophila (Mont.) Sacc. (**170: 334**; **Sacc. IV: 35**). On fruits of *Psidium guajava*, Calcutta.

MONOCHAETIA Sacc. (**Sacc. XVIII: 485**) Imp., Melanconiales.

M. depazeoides (Otth) Sacc. (**111: 315**; **Sacc. XVIII: 485**). On living leaves of *Rosa moschata*, Achibal (Kashmir).

M. mali (Ellis & Ev.) Sacc. (**111: 315**; **Sacc. XVIII: 485**). On living leaves of *Pyrus malus*, Almora (Kumaon).

MONOTRICHUM Gäumann in *Ann. mycol.*, Berl., **20**: 261. 1922. Imp., Melanconiales.

M. commelinae Gäumann (**180**: 276). On *Kordyana celebensis* Gäum. and *K. indica* Gäum. infecting *Commelina attenuata* and *C. benghalensis* respectively.

MUCOR Mich. ex Fr. (**Sacc. VII**: 190). Phyco., Mucorales (2).

M. silvaticus Hagem (**170**: 333; **Sacc. XXI**: 819). On fruits of *Nephelium litchi*, Calcutta.

MUCRONELLA Fr. (**Sacc. VI**: 512) Basidio., Hydnaceae.

M. aggregata Fr. (**6**: 243; **Sacc. VI**: 512). On dead branches of *Salvadora oleoides*, Rohtak, E. Punjab.

MUNDKURELLA Thirum. in *Mycologia*, 36: 594. 1944. Basidio., Ustilaginales (1).

M. heptapleuri Thirum. (**199**: 596). On fruits of *Heptapleurum venulosum*, Lal Bagh, Bangalore.

MYCENASTRUM Desv. (**Sacc. VII**: 134 as a synonym of *Scleroderma* Pers.) Basidio., Lycoperdales.

M. corium (Guers.) Desv. (**4**: 178; **Sacc. VII**: 142 as *Scleroderma corium* Guers) Grav.). Solitary or in groups in the ground, Ani (3000 ft.). Kulu Hills; Chamba-Dalhousie Road.

MYCOSPHAERELLA Johanson (**Sacc. IX**: 659) Asco., Sphaeriales (= *Sphaerella*).

M. agapanthi Ramakr. T. S. & K. (**158**: 98). On leaves of *Agapanthus umbellatus*, Botanical Gardens, Ootacamund (Nilgiris).

M. exaci Ramakr. T. S. & K. (**159**: 205). On leaves of *Exacum wightianum*, Coonoor, Nilgiris.

M. gleicheniae Ramakr. T. S. & K. (**159**: 206). On leaves of *Gleichenia linearis*, Coonoor, Nilgiris.

M. melothriae Ramakr. (**146a**: 159). On leaves of *Melothria mucronata*, Ootacamund.

M. prinsepiae Padwick & Merh (**127**: 2). On living leaves of *Prinsepia utilis*, Simla, 6400 ft.

M. rauwolfiae Ramakr. T. S. & K. (**159**: 206). On leaves of *Rauwolfia serpentina*, Walayar (Malabar).

MYRIOSTOMA Desv. (**Sacc. VII**: 70 as a synonym of *Geaster* Mich.) Basidio., Lycoperdales.

M. coliforme (Dicks. ex Pers.) Corda (**11**: 129; **Sacc. VII**: 73 as *Geaster coliformis* (Dicks.) Pers.). On the ground, Chandra Valley, Himalayas.

MYROTHECIUM Tode ex Fr. (**Sacc. IV**: 750) Imp., Moniliales (6A2).

M. roridum Tode ex Fr. (**118**: 56; **9**: 12; **Sacc. IV**: 750). On leaves of *Vigna unguiculata*, Bengal; on dead branches, leaves and bark of trees, Rohtak, E. Punjab.

NECTRIA Fr. (**Sacc. II**: 479) Asco., Hypocreales (B1).

[N. diploa Berk. & Curt. (**146**: 64; **Sacc. II**: 504). On scale insects on *Artocarpus integrifolia*, Agr. Res. Sta., Pattambi (Malabar). Conidial state alone was recorded in **BB**: 30.]

N. subquaternata Berk. & Br. (**183**: 19-20; **Sacc. II**: 488). On *Thea sinensis*, South India.

NEOGIBBERA Petrak in *Sydowia, Ann. mycol.*, Berl., Ser. II, 1: 191. 1947. Asco., Pyrenomycetes.

[N. aterrima (Cooke & Winter) Petrak (**RS**: 230; **Sacc. XI**: 259, **BB**: 21 as *Dimerosporium aterrimum* Cooke & Winter). On coriaceous leaves, Manipur.]

NEOTTIELLA (Cooke) Sacc. (**Sacc. VIII**: 190 as *Neottiella* Cooke) Asco., Pezizales (= *Patella* Weber ex Morg. fide Seaver).

N. catharinaea McLennan & Halsey (**50**: 57). In axils of leaves of the moss, *Catharinaea muelleri*, Himalayas: Khati, 7500 ft.; beyond Munsyari, about 7500 ft.; Mungpoo; Darjeeling, 4000 ft.)

NEOVOSSIA Koern. (**Sacc. XVI**: 375) Basidio., Ustilaginales (2).

N. brachypodii (Mundkur) Thirum. & Mundkur (**225**: 7; **108**: 51, **124**: 6 as *Tilletia brachypodii* Mundkur). In ovaries of *Brachypodium sylvaticum*, Simla, Punjab, Nainital (U.P.).

[**N. horrida** (Takahashi) Padwick & Khan (**126**: 2; **136**: 191; **Sacc. XIV**: 422, **BB**: 46 as *Tilletia horrida* Takahashi). On *Oryza sativa*, Samalkot (Madras), Cuttack (Orissa), Benares (U.P.).]

[**N. indica** (Mitra) Mundkur (**100**: 313; **104**: 54; **108**: 52; **M**: 18 as *Tilletia indica* Mitra). In ovaries of *Triticum vulgare*, New Delhi, Karnal, Saharanpur. Mundkur in **M**: 18 suggested, but did not propose, the name *Neovossia indica*.]

NITSCHKIA Otth (**Sacc. XI**: 272) Asco., Sphaeriales (AA).

N. fuckelii Nitschke (**110**: 5; **Sacc. I**: 91 as a synonym of *Coelosphaeria cupularis* (*Pers.*) Karst.). On dead branches of *Salvadora oleoides*, of *Diospyros montana*, of *Cocculus hirsutus* (as *C. villosus*), of *Maerua arenaria*, Rohtak (E. Punjab).

NYSSOPSORA Arthur in *Result sci. Congr. internat. Bot. Wien*, **1905**, p. 342. 1906. Basidio., Uredinales. (**2**).

[**N. thwaitesii** (Berk. & Br.) Syd. (**115**: 8; **Sacc. VII**: 770, **BB**; 77 as *Triphragmium thwaitesii* Berk. & Br.). On leaves of *Heptapleurum venulosum*, Bangalore (Mysore); *Heptapleurum* sp., Pussumburg, Darjeeling, Bengal; Burliar (Nilgiris).]

OCTAVIANIA Vittad. (**Sacc. VII**: 158) Basidio., Hymenogastrales.

O. longiana Ahmad (**11**: 124). On the ground, amongst grass, Rohtak (E. Punjab).

OIDIOPSIS Scalia (**Sacc. XVIII**: 507) Imp., Moniliales (3A).

O. lini Thirum. & Mundkur (**225**: 14). On leaves and tender stems of *Linum usitatissimum*, Bangalore (Mysore).

[**O. macrospora** (Uppal, Patel & Kamat) Thirum. & Mundkur (**225**: 15; **M**: 14 as *Leveillula taurica* (Lév.) Arn. v. *macrospora* Uppal. Patel & Kamat). On leaves of *Dolichos lablab*, Poona (Bombay).]

OIDIUM Link ex Fr. (**Sacc. IV**: 40) Imp., Moniliales (3A).

O. chrysanthemi Rabh. (**131**: 149; **Sacc. IV**: 43). On leaves of *Chrysanthemum* sp., Poona (Bombay).

O. cyparissiae Syd. (**131**: 149; **Sacc. XIV**: 1041). On leaves of *Euphorbia hirta* (as *E. pilulifera*), Poona (Bombay).

O. heveae Steinman (**95**: 186 as *O. hevae* Steinman). On *Hevea brasiliensis*, Valiamully Estate, South Travancore.

O. lini Skoric (**110**: 11; **131**: 149). On leaves of *Linum usitatissimum*, New Delhi; Pusa (Bihar); Dharwar (Bombay); Simla (Punjab).

O. piperis Uppal, Kamat & Patel (**236**: 258; **131**: 149; **235**: 611 as *O. piperis* Uppal & Kamat, and without diagnosis). On leaves of *Piper betle*, Bassein, Thana Dt. (Bombay).

OLIVEA Arthur in *Mycologia*, **9**: 60. 1917. Basidio., Uredinales (2).

O. tectonae (Racib.) Thirum., see *Chaconia tectonae*.

OLPIDIOPSIS Cornu (**Sacc. VII**: 299) Phyco., Lagenidiales.

O. ricciae Du Plessis (**207**: 9). In rhizoids of Hepaticae: *Riccia* sp., *Marchantia, Plagiochasma, Fimbriaria, Aneura, Notothylas*, Mysore (?)

OLPIDIUM (Braun) Rabenh. (**Sacc. VII**: 310 as *Olpidium* A. Braun) Phyco., Chytridiales (1).

O. uredinis (Lagerh.) Fischer (**195**: 363). On *Hemileia canthii*, Talakad, Mysore.

OPERCULELLA Kheswalla in *Indian J. agric. Sci.*, **11**: 317. 1941. Imp., Sphaeropsidales (1A1).

O. padwickii Kheswalla (**67**: 318). On dead stems of *Cicer arietinum*. Karnal; Delhi; Gurdaspur (E. Punjab).

OZONIUM Link ex Fr. (**Sacc. XIV**: 1187) Imp., Mycelia sterilia.

O. texanum Neal & Wester v. **parasiticum** Thirum. (**220**: 245). On potato roots causing rot, Patna (Bihar); Bhowah (U.P.); Simla (Punjab).

PANELLUS Karst. (**Sacc. XXIII**: 173) Basidio., Agaricales (= *Panus* fide Pat.)

[**P. rupicola** (Massee) Singer (**174**: 129; **Sacc. XVI**: 25, **BB**: 89 as *Collybia rupicola*). Amongst rocks, Himalayas.]

PARODIELLA (Speg.) Thiess. & Syd. (**Sacc. I**: 717; **XXIV**: 250) Asco., Erysiphales (2).

P. smithiae Uppal, Patel & Bhide (**239**: 177). On *Smithia bigemina*, Mahableshwar (Bombay).

PATELLARIA Fr. (**Sacc. VIII**: 786 gives *Patellaria* Wahl) Asco., Helotiales.

P. atrata (Hedw.) Fr. (**110**: 8). On dead wood of *Zizyphus jujuba*, Rohtak, E. Punjab; on dead branch of *Morus alba*, on dead wood of *Porsopis spicigera, Diospyros montana*. Rohtak: on dead culms of *Saccharum munja*, New Delhi.

PELLICULARIA Cooke (**Sacc. IV**: 149) Basidio., Thelephoraceae. (= *Corticium* fide Hoehnel, but see Rogers, *Farlowia* 1.).

P. alba (Dastur) Dastur (**52**: 193; **51**: 92 as *Corticium album* Dastur; see **101**: 284-85). On bark and living stems of *Citrus aurantium*. Burhampur (Nimar Dt.), M.P.

[**P. rolfsii** (Sacc.) West (**245**: 67-69; **Sacc. XXII**: 1500, **BB**: 149 as *Sclerotium rolfsii* Sacc): **M**: 25 as *Corticium rolfsii* Curzi). On *Solanum tuberosum, Arachis hypogea, Piper betle, Amorphophallus, campanulatus, Delphinium* sp., *Dianthus* sp., *Medicago sativa, Eleusine coracana, Sesbania grandiflora*.]

[**P. salmonicolor** (Berk. & Br.) Dastur (**52**: 193: **Sacc. VI**: 620, **BB**: 90 as *Corticium salmonicolor* Berk. & Br.). On living stems of *Hevea, Thea, Coffea, Cinchona ledgeriana, Citrus aurantium*.]

PENICILLIUM Link ex Fr. (**Sacc. IV**: 78) Imp., Moniliales (3A).

P. atramentosum Thom (**178**: 200). On pear fruits, U.P.

P. decumbens Thom (**170**: 333-34; **Sacc. XXII**: 1270). On fruits of *Nephelium litchi, Psidium guajava*, and *Zizyphus jujuba*, Calcutta.

P. fellutanum Biourge (**178**: 200). On fruits of *Citrus aurantium*, and *Mangifera indica*, U.P.

P. rugulosum Thom (**170**: 333-34; **Sacc. XXII**: 1272). On fruits of *Nephelium litchi* and *Zizyphus jujuba*, Calcutta.

PENZIGIA Sacc. (**Sacc. IX**: 567) Asco., Sphaeriales.

P. capparidis (Mundkur & Ahmad) Ahmad (8: 73; 110: 1 as *Bagnisiopsis capparidis* Mundkur & Ahmad). On dead branches of *Capparis aphylla*, Rohtak, E. Punjab.

PERICLADIUM Pass. (Sacc. VII: 838; em. Mundkur, *Mycologia* 36: 291). Basidio., Ustilaginales.

P. grewiae Pass. (107: 292; Sacc. VII: 838). On petioles and stems of *Grewia villosa*, Kala Chitta Hills, Attock Hills.

P. tiliacearum Mundkur & Thirum. (216: 176). On stems and petioles of *Grewia rotundifolia*, Channapatna, Mysore; *Grewia tiliaefolia*, Santaveri, Mysore.

PERONOSPORA Corda (Sacc. VII: 244) Phyco., Peronosporales (3).

P. amaranthi Gäumann (131: 143). On leaves of *Amaranthus bliti*, Poona.

P. sisymbrii-officinalis Gäumann (187: 212; Sacc. XXIV: 51). On *Sisymbrium irio*, Punjab.

P. spinaciae Laubert (110: 1; Sacc. XXI: 863 as synonym of *P. effusa*). On leaves of *Spinacia oleracea*, Bassim (M.P.)

P. trifolii-repentis Syd. (187: 201). On *Trifolium resupinatum*, Punjab.

P. viciae-sativae Gäumann (187: 197; Sacc. XXIV: 56). On *Vicia sativa*, Punjab.

PESTALOTIA de Not. (Sacc. III: 784 as *Pestalozzia*) Imp., Melanconiales (C2).

P. albo-maculans P. Henn. (111: 312; Sacc. XVIII: 480). On living leaves of *Flemmingia* sp., Ballahari, Kamrup.

P. banksiana Cavara (111: 312; Sacc. X: 489). On leaves of *Greviellea robusta*, Vayitiri, Calicut.

P. citri Mundkur & Kheswalla (111: 312). On *Citrus grandis*, Kirkee.

P. elasticola P. Henn. (111: 311; Sacc. XXV: 603). On living leaves of *Ficus elastica*, Badamtam (Darjeeling); on leaves of *Artocarpus integrifolia*, Pusa.

P. gossypii Hori ex S. Thuruda (111: 309; Sacc. XXV: 603). On living leaves of *Gossypium* sp., Aligarh.

P. lawsoniae Mundkur & Kheswalla (111: 315). On *Lawsonia alba*, Pusa.

P. longi-aristata Maublanc (111: 310; Sacc. XXV: 603). On living leaves of *Eriobotrya japonica*, Dehra Dun.

P. macrotricha Klebahn (111: 313; Sacc. XXV: 601). On living leaves of *Rhododendron campanulatum*, Ranikhet (Kumaon).

P. menezesiana Bres. & Torrend (115: 27; 131: 148; 111: 309; Sacc. XXII; 1222). On leaves of *Vitis vinifera*, Devanahalli, Mysore; of *Leea* sp., Sirsi (Bombay).

P. micheneri Guba (111: 310). On living leaves of *Araucaria* sp., Darjeeling.

P. pauciseta Sacc. (111: 313; Sacc. XXV: 608). On living leaves of *Nephelium litchi*, Pusa.

P. pipericola Mundkur & Kheswalla, see *P. piperis*.

P. piperis Petch (110: 9; 111: 341 as *P. pipericola* Mundkur & Kheswalla). On leaves of *Piper nigrum*, Wynaad (Madras), Mysore.

P. sapotae P. Henn. (111: 311; Sacc. XXV: 606. On mature fruits of *Achras sapota* Kirkee.

P. suffocata Ellis & Ev. (111: 312; Sacc. X: 485). On stems of *Rosa* sp., Pusa.

PESTALOTIOPSIS Steyaert in *Bull. Jard. bot. Brux.*, 19: 300, 1949. Imp., Melanconiales.

P. clavispora (Atk.) Steyaert (RS: 282; Sacc. XIV: 1082; 111: 311; as *Pestalotia clavispora* Atk.). On the upper surface of the living leaves of *Quercus incana*, Mussoorie.

P. funerea (Desm.) Steyaert (**RS:** 282; **Sacc. III:** 791, **BB:** 159 as *Pestalozzia funerea* Desm.). On leaves of *Cunninghamia sinensis,* Dehra Dun; of *Eucalyptus globulus,* Coonoor, *Nilgiris.*]

P. guepini (Desm.) Steyaert (**RS:** 282; **131:** 147, **Sacc. III:** 794 as *Pestalotia guepini* Desm.). On leaves of *Lagerstroemia parviflora,* Dharwar.

P. mangiferae (P. Henn.) Steyaert (**RS:** 282; **Sacc. XXII:** 1223; **111:** 309 as *Pestalotia mangiferae* P. Henn.). On living leaves of *Mangifera indica,* Poona, Dehra Dun, Pusa, Suri-Birbhum (Bengal), Sabour.

[**P. palmarum** (Cooke) Steyaert (**RS:** 282; **Sacc. III:** 796, **BB:** 159 as *Pestalozzia palmarum* Cooke). On *Cocos nucifera,* Bengal, Travancore, Madras.]

[**P. theae** (Saw.) Steyaert (**RS:** 282; **Sacc. XXV:** 607, **BB:** 159 as *Pestalozzia theae* Saw.). On leaves of *Thea sinensis,* Assam, Bengal, Madras.]

P. versicolor (Speg.) Steyaert (**RS:** 282; **131:** 336, **111:** 311, as *Pestalotia versicolor* Speg.; **Sacc. III:** 790 under *Pestalozzia*). On leaves of *Carissa* sp., Karwar.

[**P. virgatula** (Klebh.) Steyaert (**RS:** 282; **Sacc. XXV:** 599, **M:** 40 as *Pestalotia* (*Pestalozzia*) *virgatula* Klebh.). On leaves of *Mangifera indica,* Poona.]

PHAEOCHORELLA Theiss. & Syd. (**Sacc. XXIV:** 609) Asco., Dothideales (= *Sphaerodothis* fide Clements & Shear).

P. artocarpi Ramakr. T. S. & K. (**152:** 37). On leaves of *Artocarpus lakoocha,* Burliar, Nilgiris.

PHAEOPHACIDIUM P. Henn. & Lindau (**Sacc. XIV:** 814) Asco., Helotiales.

P. viburni Ramakr. T. S. & K. (**159:** 207). On leaves of *Viburnum hebanthum,* Coonoor, Nilgiris.

PHAEOSPHAERELLA Karst. (**Sacc. IX:** 723) Asco., Sphaeriales (B2).

P. ricciae Stephens (**182:** 63;**179:** 55-62). On *Riccia himalayensis,* Madras.

PHAKOPSORA Diet. (**Sacc. XIV:** 289 as *Phacopsora*) Basidio., Uredinales (1).

P. ampelopsidis Diet. & Syd. (**103:** 540; **Sacc. XIV:** 289). On *Vitis semicordata,* Mussoorie (U.P.), only uredia.

P. artemisiae Hiratsuka (**103:** 540). On *Artemisia vulgaris,* Molta (U. P).

P. fici-elasticae Ramakr. (**145:** 144). On living leaves of *Ficus elastica,* Ootacamund, Nilgiris.

[**P. incompleta** (Syd.) Cummins (**RS:** 2: 41; **Sacc. XXIII:** 786, **BB:** 68 as *Puccinia incompleta* Syd.). On leaves of *Ischaemum ciliare* v. *wallichii,* Panora, Wynaad.]

P. kirganeliae Ramakr. T. S. & K. (**157:** 76). On leaves of *Kirganelia reticulata,* Coimbatore.

P. stereospermi Mundkur, see *Mehtamyces stereospermi.*

P. tecta Jackson & Holway (**203:** 245). On leaves of *Commelina* sp., Bangalore.

PHALLUS Pers. (**Sacc. VII:** 8) Basidio., Phallales.

P. celebicus P. Henn. (**6:** 241; **Sacc. XVI:** 225 as *Ithyphallus celebicus* P. Henn.; **2:** 173 as *Ithyphallus rubicundus* (Bosc.) Fischer). Punjab plains.

PHELLORINIA Berk. (**Sacc. VII:** 145 as *Phellorina*) Basidio., Sclerodermatales.

[**P. inquinans** Berk.(**1:** 49; **74:** 134; **Sacc. VII:** 145; **BB.** 138 as *Xylopodium aitchisonii* Cooke & Massee). On soil, Said Circle, Hyderabad Forest Division; Rohtak, E. Punjab.]

P. strobilina (Kalchbr.) (**3:** 140; **Sacc. VII:** 144 as *Areolaria strobilina* (Kalchbr.).). Solitary or in groups in sandy soil, Rohtak, E. Punjab.

PHLEOSPORA Wallr. (**Sacc. III:** 577) Imp., Sphaeropsidales (1E).

P. cassiae Ramakr. T. S. & K. This is probably a synonym of *P. cassiae* Thirum. & Naras. on *Cassia fistula* since the latter appears to have been validly published earlier. See under *P. cassiae* Thirum. & Naras.

P. cassiae Thirum. & Naras. (**217:** 70; **136:** 192; **158:** 110 as *P. cassiae* Ramakr. T. S. & K.). On leaves of *Cassia fistula,* Bangalore; Benares; Kallar-Burliar (Nilgiris).

PHRAGMIDIELLA P. Henn. (Sacc. **XXI:** 131) Basidio., Uredinales (= *Kuehneola*).

P. heterophragmae (Mundkur & Thirum.) Thirum. & Mundkur (**223:** 240; **131:** 145; **114:** 627 as *Santapauella heterophragmae* Mundkur & Thirum.). On living leaves of *Heterophragma roxburghii,* Khandala (Bombay), Lalbagh, Bangalore.

PHRAGMOTELIUM Syd. in *Ann. mycol.,* Berl., **19:** 167. 1921. Basidio., Uredinales (2).

P. mysorensis Thirum. & Mundkur (**192:** 191; **230:** 203). On leaves of *Rubus niveus* (as *R. lasiocarpus*), Nandi Hills, Mysore.

PHYLLACHORA Nits. (Sacc. **II:** 594) Asco., Dothideales (4).

P. actinodaphnes Uppal, Patel & Bhide (238: 176). On leaves of *Actinodaphne hookeri,* Mahableshwar (Bombay).

P. cymbispora Ramakr. T. S. & K. (**148:** 185). On leaves of *Eurya japonica,* Lovedale, Nilgiris.

P. glycosmidis Petch (**158:** 100; Sacc. **XXIV:** 603). On leaves of *Glycosmis cochinchinensis,* Burliar (Nilgiris).

P. gudalurensis Ramakr. T. S. & K. (**158:** 101). On leaves of *Croton oblongifolius,* Gudalur, Nilgiris.

P. indica Uppal, Patel & Bhide (**238:** 176). On leaves of *Dimeria ornithopoda,* Mahableshwar (Bombay).

P. rhamni Ramakr. (**146:** 67). On leaves of *Rhamnus wightii,* Ootacamund.

P. sikkimense Ramakr. T. S. & K. (**157:** 74). On leaves of *Canarium sikkimense,* Anamalais.

PHYLLOSTICTA Pers. ex Desm. (Sacc. **III:** 3) Imp., Sphaeropsidales (1A1).

P. althaeina Sacc. (**131:** 146; Sacc. **III:** 40). On leaves of *Althea rosea,* Poona.

P. bacilliformis Padwick & Merh (**127:** 4). On leaves of *Chenopodium album,* Karnal, Punjab.

P. barleriae da Costa & Mundkur (**47:** 56). On leaves of *Barleria* sp., Dehra Dun

P. bauhiniae Cooke (**47:** 56; Sacc. **III:** 11). On leaves of *Bauhinia purpurea,* Pusa (Bihar), Bandra (Bombay).

P. bischofiae da Costa & Mundkur (**47:** 56). On leaves of *Bischofia* sp., Coota Munda (Wynaad), Madras.

P. bosensis Bose & Mathur (**29:** 210). On leaves of *Ricinus communis,* Agricultural College, Kanpur.

[**P. butleri** da Costa & Mundkur (**47:** 59; Sacc. **XXV:** 24, **BB:** 161 as *P. hoyae* Died.) On leaves of *Hoya* sp., Pusa (Bihar); of *Hoya wightii,* Khandala (Bombay). Da Costa & Mundkur (**47:** 59) state: "The name given by Diedicke is a later homonym of *Phyllosticta hoyae* Allescher, 1901."]

P. capparidis-heyneanae da Costa & Mundkur (**47:** 57). On leaves of *Capparis heyneana,* Karwar (Bombay).

P. caricae-papayae Allesch. (**47:** 57; Sacc. **XI:** 475). On leaves of *Carica papaya,* Pusa (Bihar).

P. carissae Kalch. & Cooke (**47:** 57; Sacc. **III:** 36). On leaves of *Carissa spinarum,* Dehra Dun (U. P.).

P. combreticola P. Henn. (47: 58; Sacc. XVI: 832). On leaves of *Combretum ovalifolium,* Dharwar (Bombay).

P. cucurbitacearum Sacc. (47: 58; Sacc. III: 52). On leaves of *Cucurbita* sp., Hyderabad (Deccan).

P. dioscoreae Cooke (47: 58; Sacc. III: 58). On leaves of *Dioscorea* sp., Panora (Malabar); Surat (Bombay).

P. epichloes Thirum. (209: 176). On *Epichloe cinerea,* Bangalore.

P. gastonis Roum. (131: 147). On leaves of *Musa paradisiaca* (as *M. sapientum*). Arbhavi.

[**P. hibiscina** Ell. & Ev. (47: 59; Sacc. X: 103; BB: 161 as *P. hibisci Peck*). On leaves of *Hibiscus cannabinus,* Cuttack (Orissa).]

P. morifolia Pass. (47: 60; Sacc. X: 120). On leaves of *Morus alba,* Achibal, Kashmir.

P. moringicola da Costa & Mundkur (47: 60). On leaves of *Moringa* sp., Savanur (Bombay).

P. myroxyli da Costa & Mundkur (47: 60). On leaves of *Myroxylon toluniferum,* Poona.

P. pandanicola Young (131: 147; Sacc. XXV: 62). On leaves of *Pandanus tectorius* (as *P. fascicularis*), Poona.

P. psoraleae (Cooke) Tassi (131: 147). On leaves of *Psoralaea corylifolia,* Poona.

P. roberti Boy. & Jacez. (131: 147; Sacc. XI: 476). On leaves of *Ficus elastica,* Poona.

P. sedgwickii da Costa & Mundkur (47: 61). On leaves of *Grewia tiliaefolia.* Dharwar, Karwar (Bombay).

P. sulata Chowdhury (39: 397). On leaves of *Carica papaya,* Haflong, Assam.

P. zingiberi Ramakr. (141: 170). On leaves of *Zingiber officinale,* Godavari and Malabar.

PHYSALOSPORA Niessl (Sacc. I: 433) Asco., Sphaeriales (A1).

P. achyranthis Ramakr. (146a: 161). On leaves of *Achyranthes aspera,* Kodaikanal.

P. anamalaiensis Ramakr. T. S. & K. (157: 69). On leaves of *Embelia ribes,* Anamalais.

P. cordiae Ramakr. T. S. & K. (158: 99). On leaves of *Cordia obliqua,* Walayar (Malabar).

P. heterostemmae Ramakr. T. S. & K. (149: 8). On leaves of *Heterostemma tanjorense* Kallar (Coimbatore).

P. pterolobi Ramakr. T. S. & K. (149: 7). On leaves of *Pterolobium indicum* Kallar (Coimbatore).

PHYSODERMA Wallr. (Sacc. VII: 317). Phyco. Chytridiales (6).

P. aeschynomenis Thirum. & Whitehead (231: 435). In stems and rachis of *Aeschynomene indica,* University, Benares.

P. limnanthemi Thirum. (211: 131; 65: 61). On leaves of *Limnanthemum indicum,* Bannerghatta, Bangalore.

P. trifolii (Pass.) Karling (65: 50; Sacc. XVII: 515 as *Urophlyctis trifolii* (Pass.) Magnus). On *Trifolium resupinatum,* India.

PHYTOPHTHORA de Bary (Sacc. VII: 237). Phyco., Peronosporales (2).

P. cambivora (Petri) Buis. (163: 27-33; Sacc. XXIV: 28 as *Blepharospora cambivora* Petri). On *Chrysanthemum cinerariafolium.* Nilgiris & Pulney Hills.

P. cinnamomi Rand (146: 63). On stems and roots of *Cinchona ledgeriana, C. succirubra, C.* sp., Anamalais.

P. himalayensis Dastur (53: 24). In tubers of *Solanum tuberosum,* Kufri (8000 ft.), Simla.

PILEOLARIA Cast. (**Sacc. VII:** 531 as a synonym of *Uromyces* Link) Basidio, Uredinales (2).

P. indica Syd. (185: 440). On leaves of (?*Rhus* sp.), Anacardiaceae, Wangtu Bashahr, Himachal Pradesh.

PLEOSPHAEROPSIS Died. (**Sacc. XXV:** 250) Imp., Sphaeropsidales (1A2).

P. anonae Chona & Munjal (36: 108). On dead twigs of *Anona squamosa,* Kumaon.

P. crotonis Chona & Munjal (36: 109). On dead twigs of *Croton* sp., Pusa.

P. fici Chona & Munjal (36: 110). On dead twigs of *Ficus* sp., Ganesh Khind Botanic Gardens, Poona.

P. psidii Chona & Munjal (36: 111). On dead twigs of *Psidium guajava,* Ganesh Khind Botanic Gardens, Poona.

P. thevetiae Chona & Munjal (36: 111). On dead twigs of *Thevetia neriifolia,* Mycological Area, Indian Agr. Res. Inst., New Delhi.

PLOWRIGHTIA Sacc. (**Sacc. II:** 635) Asco., Dothideales (3).

P. atlantiae Ramakr. T. S. & K. (159: 208). On leaves of *Atlantia monophylla,* Burliar, Nilgiris.

P. indica Ramakr. T. S. & K. (157: 73). On leaves of *Jambosa laeta,* Anamalais.

POLYPORUS Mich. ex Fr. (**Sacc. VI:** 55). Basidio., Polyporaceae.

P. agaricеus Berk. (30: 153; **Sacc. VI:** 67). Bengal (?).

P. circinatus Fr. (30: 154; 31: 62; 15: 218; **Sacc. VI:** 105 gives *P. circinatus* Morgan). Growing on the ground attached to buried wood, Darjeeling; on Conifers, Himalayas.

P. dictyopus Berk. (31: 55; 22:: 48). Growing on stumps and logs of deciduous trees, Calcutta and suburbs.

P. gilvus Schw. forma **gilvoides** (Schw.) Fr. (30: 153; 31: 59; 22: 48). Growing on stumps and logs, U. P., Calcutta, Darjeeling, Assam; on logs of *Mangifera indica, Cocos nucifera, Grewia asiatica, Bauhinia purpurea, Shorea robusta, Odina wodier,* Calcutta.

P. gilvus Schw. forma **lichnoides** (Mont.) Lloyd (23: 194; 30: 153; 31: 60; 22: 49). On dead bamboo, Calcutta; growing on dead wood, Calcutta, Burdwan, Darjeeling, Hill Tippera; on logs of *Adinandra javanica, Achras sapota, Swietenia mahagoni, Shorea robusta, Moringa pterygosperma, Dalbergia sissoo,* Calcutta.

P. interruptus Berk. & Br. (233: 23). On tea, Assam.

P. mesotalpae Lloyd (233: 23). On tea, Assam.

P. obtusus Berk. (17: 129; **Sacc. VI:** 134). On living *Quercus semicarpifolia, Q dialatata* and oak, W. Himalayas, between 6000-12000 ft.

P. personatus Berk. & Br. (30: 153; 31: 63; 22: 51). Growing on stumps and logs, Madras, Bombay, Calcutta and suburbs.

P. pusillus Pers. (6: 244; **Sacc. XXI:** 273 gives *P. pusillus* (Murrill) Sacc. & Trott.). on dead leaf bases of *Saccharum munja,* Jaggatpur, Gurdaspur Dt. E. Punjab).

P. radiatus (Sow.) Fr. (31: 56; **Sacc. XXIII:** 378 gives *P. radiatus* Sow. forma ?). Growing on dead wood, Kuseong.

POLYSTICTUS Fr. (**Sacc. VI:** 208) Basidio., Polyporaceae.

[**P. grammocephalus** (Berk.) S. Ito & Imai (**RS:** 18; **Sacc. VI:** 92, **BB:** 116 as *Polyporus grammocephalus* Berk.). On stems on dense forest, dead wood, dead trunks, Kalsia; Poona; Hooghly, Bengal; Sidapur, Coorg; South India.]

PORONIA Willd. ex Fr. (**Sacc. I**: 348) Asco., Sphaeriales (A2).

P. kurziana (Curr.) Lloyd (**7**: 141; **Sacc. II**: Add. xxix as *Kretzschmaria kurziana* (Curr.) teste Cooke?) On dead and burnt culms of *Saccharum munja*, Jaggatpur, Gurdaspur; on brick-laid paths where fire had been burnt, rainy season, Botanic Garden, Calcutta.

P. leporina Ell. & Ev. (**7**: 139; **Sacc. IX**: 542). On rabbit dung, Jaggatpur, Gurdaspur; Rohtak, E. Punjab.

P. punctata (L.) Fr. (**7**: 140; **Sacc. I**: 348). Doubtfully recorded by Ahmad (**7**: 140) on the authority of Lloyd.

PSATHYRELLA (Fr) Quel. (**Sacc. V**: 1126) Basidio., Agaricaceae.

P. disseminata (Pers.) Fr. (**22**: 44; **Sacc. V**: 1134). On decaying wood, specially about much decaying stumps and on ground, Calcutta.

PSEUDOLYCOPERDON Valenovsky in *Novitates Mycologicae Novissimae*, p. 93. 1947. (**RS**: 193). Basidio., Gasteromycetes.

[**P. pusillum** (Batsch) Valenovsky (**RS**: 193; **BB**: 137 as *Lycoperdon pusillum* Batsch; **Sacc. VII**: 110 as *L. pusillum* under *L. furfuraceum* Schaeff.). On the ground, Dehra Dun.]

PSEUDOPEZIZA Fuckel (**Sacc. VIII**: 723) Asco., Helotiales.

P. indica Ramakr. T. S. & K. (**157**: 67). On leaves of *Embelia ribes*, Anamalais.

P. rubiae Ramakr. T. S. & K. (**147**: 31). On living leaves of *Rubia cordifolia*, Lovedale, Coonoor, Nilgiris.

P. skimmiae Padwick (**123**: 1). On living leaves of *Skimmia laureola*, Aru, Kashmir, 8800 ft.

PSEUDOPHACIDIUM Karst. (**Sacc. VIII**: 776) Asco., Phacidiales (= *Hypoderma* fide Nannfeldt).

P. photiniae Ramakr. & Sriniv. (**146a**: 158). On leaves of *Photinia notoniana*, Kodaikanal.

PUCCINIA Pers. (**Sacc. VII**: 600) Basidio., Uredinales (**2**).

P. abutili Berk. & Br. (**115**: 13; **Sacc. VII**: 695). On leaves of *Abutilon indicum*, Uttarhalli, Bangalore.

P. acrophila Peck (**44**: 450; **Sacc. VII**: 727). On *Lagotis glauca*, Deosai Plains, on Skardu Road.

P. ahmadiana Syd. (**185**: 438). On *Pterotheca falconeri*, Puti Runi, Lahul.

P. anodae Syd. (**115**: 13; **Sacc. XVII**: 352). On leaves of *Kydia calycina*, Dehra Dun (U. P.).

P. baryi (Berk. & Br.) Wint. (**153**: 64; **Sacc. VII**: 737). On leaves of *Brachypodium sylvaticum*, Ootacamund.

P. behenis (DC.) Otth (**44**: 451). On *Lychnis inflata*, Shankargarh, Upper Astor Valley; on *Silene latifolia*, Upper Astor Valley.

P. bellurensis Thirum. (**200**: 303). On leaves of *Evolvulus alsinoides*, Bellur (Mysore).

P. bistortae (St.) DC. (**185**: 439; Sacc., **VII**: 638). On leaves of *Polygonum viviparum*, Losar, Spiti.

P. boerhaviafoliae Thirum. (**200**: 304) On leaves and twigs of *Blepharis boerhavifolia*, Yeashwantpur (Mysore).

P. bottomleyae Doidge (**203**: 238). On leaves and inflorescence of *Aristida depressa*, Hebbal, Bangalore.

P. bulbostylidicola Thirum. (**203**: 239). On leaves and peduncles of *Bulbostylis barbata*, Hebbal, Bangalore.

P. carduorum Jacky (**126**: 6; **Sacc, XVI**: 297). On leaves of *Carduus nutans*, near Aru, Kashmir, 9000 ft.

[**P. caricis** (Schum.) Rebent. v. **himalayensis** Barclay (**126**: 9; **BB**: 65 under *P. caricis*). On *Urtica parviflora*, Mussoorie.]

P. caricis-nubigenae Padwick & Khan (**126**: 8). On leaves of *Carex nubigena*, Kufri, Patiala, 8800 ft.

P. chomeliae Thirum., see *P. spongiosa* Berk. & Br.

P. cousiniae Syd. (**185**: 438; **Sacc, XVII**: 293). On leaves of *Cousinia thomsoni*, Kioto, Spiti.

P. drabae Rud. (**44**: 452; **Sacc. VII**: 683). On *Draba altaica*, Zojibal Pass.

P. eragrostidis Petch (**124**: 3; **Sacc. XXIII**: 733). On living leaves, leafsheaths and axes of inflorescences of *Eragrostis nigra*, Nainital.

P. erebia Syd. (**115**: 14; **Sacc, XXIII**: 783). On leaves of *Clerodendron inerme*, Bangalore.

P. eremuri Komarov (**115**: 10; **Sacc. XVI**: 306). On both sides of leaves of *Eremurus himalaicus*, Kylang, Lahoul (Punjab).

P. erianthi Padwick & Khan (**126**: 10). On leaves of *Erianthus fulvus*, Simla.

P. exhauriens Thuem. (**203**: 241;**156**: 54; **Sacc, VII**: 714). On leaves of *Jasminum* sp., Nalur, Thirthahalli, Mysore; on leaves of *Jasminum pubescens*, Cinchona, Anamalais.

P. heracleicola Cummins (**44**: 452). On *Heracleum thomsoni* v. *glabrior*, ascent Lohan Gali, near Tilel, Kashmir.

P. holboelliae-latifoliae Cummins (**44**: 453). On *Holboellia latifolia*, Camel's Back, Mussoorie.

P. jasminicola Ramakr. T. S. & K. (**156**: 53). On leaves of *Jasminum flexile*, Burliar, Nilgiris.

P. leiocarpum (Syd.) Thirum. (**188**: 469; **230**: 195; **Sacc. XXIII**: 898, **BB**: 53 as *Aecidium leiocarpum Syd.*). On leaves of *Ocimum adacendens*, Bangalore, Nandi Hills (Mysore).

P. leucadis Syd. (**144**: 48; **Sacc, XVII**: 329). On leaves of *Leucas linifolia*, Kodaikanal.

P. leveillei Mont. (**44**: 453; **Sacc. XI**: 185). On *Geranium collinum*, Satpura Nullah, Baltistan; *Geranium pratense*, ascent Lohan Galli; *G. rectum*, Kun Patthar; *G.* sp., Kun Patthar to Waziri Thal.

P. libani P. Magn. (**44**: 453; **Sacc, XVI**: 280). On *Prangos pabularia*, Lohan Gali, near Purana Tilel.

P. liberta Kern (**110**: 8; **Sacc, XXIII**: 720). On stems of *Bulbostylia barbata*, Rohtak, E. Punjab.

P. ligustici Ell. & Ev. (**44**: 454; **Sacc, XIV**: 303). On *Selinum papyraceum*, Burzil Chowki, Gilgit Road.

P. longirostris Kom. (**44**: 454; **Sacc, XVI**: 303). On *Lonicera asperifolia*, Satpura Valley above Skardu, Baltistan.

P. linkii Klotzsch (**147**: 33; **Sacc, VII**: 725). On leaves of *Viburnum erubescens*, Ootacamund.

P. luculenta (Syd.) Ramakr. T. S. & K. (**152**: 39; **Sacc, XXI**: 781, **BB**: 53 as *Aecidium luculentum* Syd.). On leaves of *Loranthus longiflorus*, Attakatti, Anamalais.

P. melasmioides Tranz. (**44**: 455; **126**: 5; **Sacc, XVII**: 357). On stems, leaves and petioles of *Aquilegia vulgaris*, above Aru, Kashmir (11000 ft.); on *A. vulgaris* v. *alpina*, below Kun Patthar; Chillam, below Burzil Pass.

P. melothriicola Syd. (**144**: 46; *as P. melothricola*). **Sacc. XXIII**: 714. On leaves of *Melothria mucronata* (telia only).

P. monticola Kom. (**185**: 439; **44**: 455; **Sacc, XVI**: 304). On leaves of *Polygonum tortuosum*, Buldar, Spiti;on *P. alpinum*, Chillam, Burzil Pass, Gilgit Road; Godai to Chillam.

P. oahuensis Ell. & Ev. (**203**: 242; Sacc. **XIV**: 357). On leaves of *Digitaria marginata*, Hebbal, Bangalore.

P. operta Mundkur & Thirum. (**115**: 10; Sacc, **XXI**: 808, **BB**: 79 as *Uredo operta* Syd. & Butler). On leaves of *Coix lachryma-jobi*, Girnar Hills, Junagadh; Wynaad (Madras).

P. phyllocladiae Cook (**203**: 242; Sacc. **VII**: 733 as *P. phyllocladia*). On cladodes of *Asparagus* sp., Korekote, Thirthahalli, Mysore; Balehonnur, Mysore.

P. picridis Haszl. (**144**: 46; Sacc, **VII**: 652). On leaves of *Picris hieracioides*, Kodaikanal.

P. plicata Kom. (**44**: 455; Sacc. **XVI**: 280). On *Prangos pabularia*, Lohan Gali near Purana Tilal; above Minimarg, Gilgit Road.

P. prenanthes-purpureae (DC) Lindr. (**44**: 455; Sacc. **XVII**: 306). On *Lactuca decipiens*, above Chorwan; Chorwan to Burzil Chowki.

P. rhynchosporae Syd.(**153**: 65; Sacc. **XXIII**: 721). On leaves of *Rhynchospora* sp., Siddapur, Coorg.

P. ribesii-caricis Kleb. (**44**: 452). On *Ribes nigrum*, Chillam, Gilgit Road.

P. sacchari Patel, Kamat & Padhye (**132**: 121 without diagnosis). On *Saccharum officinarum*, Deccan Canal, Bombay.

P. shiraiana Syd. (**203**: 243; Sacc. **XVI**: 300). On leaves and petioles of *Justicia* sp., Balehonnur and Lakkavalli, Mysore.

P. solani-giganteae Ramakr. T. S. & K. (**148**: 180). On leaves of *Solanum giganteum*, Naduvattam, Nilgiris.

[**P. spongiosa** Berk. & Br. (**213**: 340; **BB**: 74; **194**: 197, **230**: 197 as *P. chomeliae* Thirum.). On leaves and twigs of *Chomelia asiatica*, Mysore.]

P. thomasiana Ramakr. T. S. & K. (**153**: 60). On leaves of *Ocimum gratissimum*, Anamalais.

P. tricholaenae (Syd.) Ramakr. T. S. & K. (**153**: 64; Sacc. **XXIII**: 787 as *Diorchidium tricholaenae* Syd.). On leaves of *Rhynchelytrum roseum*, Coonoor, Nilgiris.

P. tricholepidis Syd. (**185**: 438). On leaves of *Tricholepis elongata*, Sarahan, Bashahr, Himachal Pradesh.

P. tweediana (Speg.) Ramakr. T. S. & K. (**153**: 62; **Sacc. VII**: 817, **BB**: 55 as *Aecidium tweedianum* Speg.). On leaves of *Dicliptera cuneata*, Yercaud, Salem Dt.

P. vernoniae-monosis Ramakr. T. S. & K. (**152**: 42). On leaves of *Vernonia monosis*, Valparai, Anamalais.

P. volutarellae Thirum. (**200**: 302). On leaves of *Volutarella divaricata*, Bellur, Mysore.

PYTHIUM Pringsh. (**Sacc. VII**: 270) Phyco., Peronosporales (2).

P. carolinianum Matthews (**19**: 27). In water containing vegetable debris, Coimbatore.

P. catenulatum Matthews (**19**: 34). Parasitic on *Spirogyra* spp. in rice fields, Vedapatti, Coimbatore.

P. debaryanum Hesse v. **viticolum** Jain (**63**: 9). On roots of *Vitis vinifera*, Tharsa Experimental Farm, M.P.

P. indicum Balakr. (**18**: 171; **181**: 227). On *Hibiscus esculentus*, Podanur, Coimbatore; causing damping off of seedlings of *Saponaria*, Botanic Garden, Kanpur, U.P. In artificial inoculations (**18**: 161-73), the following were infected: *Nicotiana tabacum*, *N. glutinosa*, *Solanum melongena*,

S. nigrum, Capsicum annuum, Lycopersicon esculentum, Petunia sp., *Carica papaya, Cucurbita maxima, Zea mays, Amaranthus gangeticus* and *Vigna catjang. Datura fastuosa* and *Pennisetum typhoides* were immune.

P. intermedium de Bary (79: 65; **Sacc. XI:** 244). On roots of *Cyperus papyrus, C. alternifolius* and *C. eleusinoides,* Nagpur.

P. myriotylum Drechsler (91: 64: 234: 203-211; 131: 143). On *Zingiber officinale,* Surat (Bombay).

P. paroecandrum Drechsler (19: 28). Isolated from rotting pods of *Phaseolus vulgaris,* New Market, Coimbatore.

P. periplocum Drechsler v. **coimbatorensis** Balakr. (19: 31). Isolated from vegetable debris in water, Coimbatore.

[**P. vexans** de Bary (91: 95; 143: 27-29; **M:** 9 as *P. piperina* (for *piperinum*) Dastur). On *Piper betle* and *P. longum,* Hoshangabad; causing diseases of *Zingiber officinale* (Wynaad); *Elettaria cardamomum* (Travancore, Tinnevelly, Coimbatore, Madura); *Pelargonium* sp., (Shevroy Hills, Yercaud); *Cinchona officinalis, C. ledgeriana, C. succirubra* and other hybrids, Anamalais; *Pyrus malus,* Pomological Station, Coonoor, Nilgiris.]

QUELETIA Fr. (**Sacc. VII:** 65) Basidio., Sclerodermatales.

Q. laceratum (Ehrenb.) Ahmad (3: 136; **Sacc. VII:** 63 as *Tylostoma laceratum*). The Punjab plains.

Q. mundkuri Ahmad, see *Schizostoma mundkuri.*

RAMULARIA Sacc. (**Sacc. IV:** 196 gives *Ramularia* Ung. em. Sacc.) Imp., Moniliales (3C).

R. decipiens Ell. & Ev. (124: 9; **Sacc. VII:** 215). On leaves of *Rumex orientalis, R. nepalensis,* Simla.

R. mimosae Stevens & Dal. (217: 67; 131: 149; **Sacc. XXV:** 733). On leaves of *Mimosa pudica,* Bangalore; Sirsi (Bombay).

RAMULISPORA Miura in *S. Manch. Agr. Bull.* 11: 43. 1920. Imp., Melanconiales (= *Titaeospora* fide Clements & Shear).

R. alloteropsidis Thirum. & Naras. (217: 72). On leaves of *Alloteropsis cimicina,* Bangalore.

RAVENELIA Berk. (**Sacc. VII:** 770) Basidio., Uredinales (2).

R. acaciae-arabicae Mundkur & Thirum. (115: 17). On leaves of *Acacia arabica,* Hessarghatta (Mysore), Coimbatore (Madras).

R. acaciae-concinnae Mundkur & Thirum. (115: 18). On leaves of *Acacia concinna,* Bangalore (Mysore).

R. acaciae-sumae Mundkur & Thirum. (115: 18). On leaves of *Acacia suma,* Dasarhalli (Mysore).

R. albizziae-amarae Baccarini (115: 19; **Sacc. XXIII:** 797). On leaves of *Albizzia amara,* Vellore (Madras).

[**R. berkeleyi** Mundkur & Thirum. (115: 19; **BB:** 76 as *R. indica* Berk.). On leaves, stems, fruits of *Cassia absus,* Bellur (Mysore), Madras State, Nagpur (M.P.).]

R. breyniae-patentis Mundkur & Thirum. (115: 21). On leaves of *Breynia patens,* Jalahalli (Mysore).

R. kirganelliae Mundkur & Thirum. (115: 22). On leaves of *Kirganelia reticulata* (as *Phyllanthus reticulatus*), Malleshwaram (Mysore); Pusa (Bihar).

R. phyllanthi Mundkur & Thirum. (115: 24). On leaves of *Phyllanthus polyphyllus*, Bannerghatta (Mysore).

R. stictica Berk. & Br. (115: 25; Sacc. VII: 772). On leaves of *Mundulea suberosa*, Madras State.

RHIZOPOGON Fr. (Sacc. VII: 161) Basidio., Hymenogastrales.

R. roseolus (Corda) Hollos (11: 128). On the ground, Murree; Changla gali.

R. rubescens Tul. (4: 174; Sacc. VII: 161). Soil, epigeous, Dalhousie.

RHYTISMA Fr. (Sacc. VIII: 752) Asco., Phacidiales (2).

R. salicinum Fr. (110: 7; Sacc. VIII: 753). On fallen leaves of *Salix tetrasperma*, Simla.

ROSELLINIA de Not. (Sacc. I: 252) Asco., Sphaeriales (A2).

R. bonaerensis Speg. (123: 3). On the base of dead stems of *Arundinaria falcata*, Nainital, U.P.

SANTAPAUELLA Mundkur & Thirum. in *Mycologia*, 37: 625. 1945. Basidio., Uredinales (1) (= *Phragmidiella* fide Thirum. & Mundkur).

S. heterophragmae Mundkur & Thirum., see *Phragmidiella heterophragmae*.

SCHIZOSTOMA Ehrenb. ex Lév. (Sacc. XX: 753) Basidio., Sclerodermatales.

S. mundkuri (Ahmad) Long & Stouffer (RS: 83; 3: 136 as *Queletia mundkuri* Ahmad). Solitary in sandy soil, Rohtak, E. Punjab.

SCHIZOXYLON Pers. ex Chev. (Sacc. VIII: 697) Asco., Helotiales.

S. insigne (de Not.) Rehm (9: 11). On dead branches of *Punica granatum*, Rohtak, E. Punjab.

SCLEROSPORA Schroet. (Sacc. VII: 238) Phyco., Peronosporales (3).

S. iseilematis Thirum. & Naras. (227: 49). On *Iseilema laxum*, Nandi Hills, (Mysore).

SCLEROTIOPSIS Speg., (Sacc. III: 184) Imp., Sphaeropsidales (1A1).

S. indica Ramakr. & Sriniv. (146: 71). On leaves of *Ilex wightiana*, Kodaikanal.

SCOLECOSPORIUM Lib. (Sacc. III: 782). Imp., Melanconiales (C2).

S. phoebei Ramakr. (146: 70). On leaves of *Phoebe paniculata*, Ootacamund.

SCOPELLA Mains in *Ann. mycol.*, Berl., 37: 58. 1939. Basidio., Uredinales (2).

S. ascotela (Syd.) Ramakr. T. S. & K., see *Maravalia ascotela*.

[**S. aulica** (Syd.) Mundkur & Thirum. (225: 11; 45: 208: M: 24 as *Uromyces aulicus* Syd.). On leaves of *Mimosops elengi*, Koteshwar (Madras); Dapoli (Bombay).]

[**S. echinulata** (Niessl) Mains (83: 57-60; 45: 210; 218: 229; 136: 191; Sacc. VII: 557, BB: 81 as *Uromyces echinulatus* Niessl). On leaves of *Bassia latifolia*, Calcutta, Bangalore, Palghan (Bombay), Penagalum (Cuddapah), Benares; on *B. bourdilli*, near Bangalore (Mysore).]

S. fici Mundkur & Thirum. (115: 9; 203: 236). On leaves of *Ficus* sp., Shambaganur (Madras), Balehonnur (Mysore).

[**S. gentilis** (Syd.) Mundkur & Thirum. (225: 12; 45: 206; M: 24 as *Uromyces gentilis* Syd.). On leaves of *Mimusops hexandra*, Allahabad.]

[**S. mimusops** (Cooke) Cummins (45: 209; Sacc. VII: 579 as *Uromyces mimusopsidis* Cooke; BB: 83 as *U. mimusops* Cooke). On leaves of *Mimusops elengi*, South Kanara; Bombay.]

SCOPELLOPSIS Ramakr. T. S. & K. in *Proc. Indian Acad. Sci.*, B. 26: 62. 1947. Basidio., Uredinales (2) (= *Maravalia* fide Thirumalachar).

S. dalbergiae Ramakr. T. S. & K., see *Maravalia pterocarpi*.

SEPTOGLOEUM Sacc. (**Sacc. III:** 801) Imp., Melanconiales (C1).

S. feroniae Ramakr. T. S. & K. (**157:** 77). On leaves of *Feronia elephantum*, Perur, Coimbatore.

S. scutiae Ramakr., T. S. & K. (**158:** 109). On leaves of *Scutia myrtina*, Kotagiri, Nilgiris.

SEPTORIA Sacc. (**Sacc. III:** 474) Imp., Sphaeropsidales (1E).

S. acetosae Oud. (**36:** 106 as *S. acteosae*; **Sacc. XI:** 545). On leaves of *Rumex hastatum*, Flowerdale, Simla.

S. achyranthis Chona & Munjal (**36:** 107). On leaves of *Achyranthes aspera*, Flowerdale, Simla.

S. apii-graveolentis Dorogin (**127: 6; Sacc. XXV:** 454). On living leaves of *Apium graveolens*, Gunderbal, Kashmir.

S. cynodontis Fuckel (**209:** 175; **Sacc. III:** 562). On leaves and sheaths of *Cynodon dactylon*, Bangalore (Mysore).

S. dianthi Desm. (**159:** 212; **Sacc. III:** 516). On leaves of *Dianthus caryophyllus* and *Dianthus* spp., Coonoor, Nilgiris.

S. erythrinae Ramakr. T. S. & K. (**149:** 10). On leaves of *Erythrina* sp., Kallar (Coimbatore).

S. geranii Rob. & Desm. (**36:** 107; **Sacc. III:** 514). On leaves of *Fragaria indica*, Flowerdale, Simla.

S. graminum Desm. (**158:** 111; **Sacc. III:** 565). On leaves of *Digitaria marginata*, Walayar (Malabar).

S. gypsophilae Died. v. **macrospora** Padwick & Merh (**127: 6**). On living leaves of *Gypsophila cerastioides*, Katarnag, Kashmir, 11500 ft.

S. hydrocotyles Desm. (**159:** 212; **Sacc. III:** 531). On leaves of *Hydrocotyle javanica*, Anamalais.

S. mortolensis Penz. & Sacc. (**131:** 147 as *S. mortolensis* Penz.; **Sacc. III:** 490). On leaves of *Acacia arabica*, Vir, Saswad (Bombay).

S. petroselini Desm. (**123: 7; Sacc. III:** 530). On living leaves of *Petroselinum crispum*, Srinagar, Kashmir.

S. phlogis Sacc. & Speg. (**159:** 212; **Sacc. III:** 533). On leaves of *Phlox* sp., Sim's Park, Coonoor, Nilgiris.

S. polygonorum Desm. (**36:** 108; **Sacc. III:** 555). On leaves of *Polygonum recumbens*, Flowerdale, Simla.

S. swertiae Pat. (**209:** 175; **Sacc. X:** 376). On leaves of *Swertia* sp., Kemmangudi (Mysore).

S. thespesiae Ramakr. T. S. & K. (**149:** 11). On leaves of *Thespesia populnea*, Coimbatore.

S. urticae Desm. & Rob. (**36:** 108; **Sacc. III:** 557). On leaves of *Urtica dioica*, Flowerdale, Simla.

SIMBLUM Klotzsch (**Sacc. VII:** 16) Basidio., Phallales.

S. sphaerocephalum Schlecht. (**2:** 175; **Sacc. VII:** 16). Solitary or in groups, very common in grassy plots, Rohtak (E. Punjab).

SIROBASIDIUM Lagerh. & Pat. (**Sacc. XI:** 148) Basidio., Tremellales (**2A**).

S. indicum Ramakr. & Subram. (**140:** 304). On dead twigs, Christian College campus, Tambaram, near Madras.

SOROSPHAERA Schroet. (**Sacc. VII:** 466) Phyco. ?, Plasmodiophorales.

S. veronicae Schroet. (**110:** 1; **Sacc. VII:** 466). Forming galls on leaves and stems of *Veronica agrestis*, Rohtak, E. Punjab.

SOROSPORIUM Rud. (**Sacc. VII:** 511) Basidio., Ustilaginales (1).

S. azmatii Mundkur, see *S. tumefaciens*.

[**S. crypticum** (Cooke & Massee) Ling (72: 131; **Sacc. IX: 285, BB:** 44 as *Cintractia cryptica* Cooke & Massee). On *Eulalia tristachya* (as *E. argentea*), Munepore, India.]

[**S. digitariae** (Kunze) Padwick (124: 8; **135:** 110; **Sacc. VII:** 454, **BB:** 48 as *Ustilago digitariae*). On *Urochloa reptans*, Mysore.]

S. everhartii Ell. & Gallow. (225: 5; **Sacc. IX:** 289). On inflorescence of *Cymbopogon coloratus*, Bellur (Mysore).

S. heteropogonicola Thirum. & Mundkur (225: 5). In the ovaries of *Heteropogon contortus*, Nandi Hills, (Mysore).

S. indicum Mundkur (102: 215). On *Saccharum munja*, Cuttack (Orissa).

S. ischaemi Ling (73: 80). On *Ischaemum rugosum*, Kumta, Poona (Bombay).

S. iseilematis Thirum. (216: 175). In ovaries of *Iseilema laxum*, Nandi Hills (Mysore).

S. kuwanowanum Togashi & Maki (225: 6). In ovaries of *Bulbostylis barbata*, Hebbal (Mysore).

S. penniseti Mundkur (98: 116). On *Pennisetum ciliare*, Delhi.

S. tumefaciens McAlp. (98: 115 as *S. azmatii* Mundkur). On *Chrysopogon coerulens*, Bilikere (Mysore). Herbert & Langdon (*Univ. Queensland Papers Dept. Biol.*, **2:** 1-6, 1941) list *S. azmatii* Mundkur as a synonym of *S. tumefaciens* McAlp., the host of the latter being *Chrysopogon* and not *Stipa* as originally stated.

SPEGAZZINIA Sacc. (**Sacc. IV:** 758) Imp., Momiliales (6G).

S. ornata Sacc. (36: 112 as *S. oronata;* **Sacc. IV:** 758). On dead leaves of *Cynodon dactylon*, Botanical area, Indian Agr. Res. Institute, New Delhi.

SPHACELOMA de Bary (**Sacc. XX:** 815) Imp., Melanconiales (A1).

S. curcumae Thirum. (206: 6). On leaves of *Curcuma* sp., Kemmangudi (Mysore).

S. fawceti Jenkins (131: 149). On leaves and fruits of *Citrus grandis*, Poona.

S. oleandri Thirum. (206: 5). On leaves of *Nerium oleander*, Koppa Road; Kemmangudi (Mysore).

S. osyridis Thirum. (206: 3). On leaves of *Osyris arborea* (as *O. wightiana*). Nandi Hills, Mysore.

S. santali Thirum. (206: 2). On leaves of *Santalum album*, Lakkavali, Mysore.

SPHACELOTHECA de Bary (**Sacc. VII:** 499) Basidio., Ustilaginales (1).

[**S. annulata** (Ell. & Ev.) Mundkur (98: 92; 107: 289; 131: 149; **Sacc. IX:** 288, **BB:** 49 as *Ustilago duthiei* Ricker). On *Dichanthium annulatum*, Dehra Dun; Coimbatore; Bassein; Pathankot, Punjab plains; Poona.]

[**S. apludae** Pavgi & Mundkur (135: 110; **BB:** 48 as *Ustilago arundinellae* Syd. & Butler). On *Apluda aristata* (as *A. varia* v. *aristata*), Kumaon, Himalayas. Pavgi & Mundkur state: 'This grass was identified as *Arundinella setosa* Trin. and the smut by Butler & Bisby as *Ustilago arundinellae* Brefeld—both misdeterminations.']

[**S. aristidae-cyananthae** (Brefeld) Pavgi & Mundkur (135: 111; **Sacc. XIV:** 415, **BB:** 47 as *Ustilago aristidae-cyananthae* Brefeld). On *Aristida* sp., Dehra Dun.]

S. arundinellae (Brefeld) Mundkur (98: 113; **Sacc. XIV:** 415 as *Ustilago arundinellae* Brefeld). On *Arundinella* sp., Calcutta (?) The fungus recorded as *Ustilago arundinellae* Brefeld in **BB:** 48 is not this fungus; see under *Sphacelotheca apludae.*

[**S. bengalensis** (Syd. & Butler) Mundkur (**98**: 108; **Sacc. XXIII**: 609, **BB**: 48 as *Ustilago bengalensis* Syd. & Butler). On *Cymbopogon pendulus*, Banarhat, Doars, Bengal.]

[**S. bursa** (Berk.) Mundkur & Thirum. (**115**: 6; Sacc. **VII**: 473. **BB**: 48 as *Ustilago bursa* Berk.). According to Mundkur & Thirumalachar (**115**: 6), in ovaries of *Anthistiria* sp., Ninar, M. P. (Burkill); Labada, M.P. (Burkill); Hoshangabad, M.P. (Butler); Surat, Bombay (Butler); Bassein, (Bombay) (Bhide); in ovaries of *Themeda quadrivalvis* (as *Anthistiria ciliata*), Nagpur, M.P.; type on *Anthistiria arundinacea* from Sikkim. However, Ling (**73**: 74) says: The collection (I. H. Burkill 1419) reported by Sydow & Butler (*Ann. mycol.* **10**: 243-80, 1912) and by Mundkur & Thirumalachar (**115**: 6) as *Ustilago bursa* is not this species and also differs somewhat from other species recorded on *Themeda*.]

S. chloridis Mundkur (**108**: 50). In ovaries of *Chloris barbata*, Bangalore, Mysore.

S. chrysopogonicola Thirum. & Mundkur (**225**: 2). On inflorescence of *Chrysopogon* sp., Uttarahalli, Bangalore (Mysore).

S. consueta Syd. (**186**: 442). On inflorescence of *Cymbopogon parkeri*, Shahkot Hills, Punjab.

[**S. cornuta** (Syd. & Butler) Mundkur (**98**: 110; Sacc. **XXI**: 501 as *Ustilago cornuta* Syd. & Butler; **BB**: 48 as *U. cornuti* Syd. & Butler). In the unopened spikes, rarely in the flowers, of *Ophiurus exaltatus* (as *O. corymbosus*), Surat.]

S. cymbopogonis-colorati Thirum. & Mundkur (**225**: 3). In ovaries of *Cymbopogon coloratus*, Bellur, Mysore; on *C. flexuosus*, Bargur, Salem (Madras).

[**S. destruens** (Schlecht.) Stevenson & Johnson (**109**: 110; **135**: 111; **Sacc. VII**: 454, **BB**: 50 as *Ustilago panici-miliacei* (Pers.) Wint.). On *Panicum miliaceum*, Larkipur, Kashmir.]

S. dichanthicola Thirum. & Mundkur (**225**: 3). In ovaries of *Dichanthium caricosum*, Hebbal, Mysore.

S. dinebrae Mundkur (**98**: 109). On *Dinebra retroflexa*, Banarhat, Bengal.

S. erianthi (Syd.) Mundkur (**102**: 213; Sacc. **XXIII**: 610 as *Ustilago erianthi* Syd.). On *Saccharum* sp., near Soane river.

[**S. erythraeensis** (Syd.) Clinton (**135**: 112; **136**: 191; Sacc. **XXIII**: 611; **BB**: 49 as *Ustilago erythraensis* Syd.). On *Manisuris* sp., Dharwar and Dohad (Bombay); on *Hackelochloa granularis* (as *Manisuris granularis*), Pusa, Benares; Belari, Amraoti.]

[**S. inayati** (Syd. & Butler) Mundkur & Thirum. (**215**: 172; Sacc. **XXI**: 500; **BB**: 49 as *Ustilago inayati* Syd. & Butler). In ovaries of *Iseilema laxum*, Ovai (U. P.); Paduvigere (Mysore).].

[**S. iseilematis** (Syd. & Butler) Mundkur & Thirum. (**215**: 172; Sacc. **XXI**: 500; **BB**: 49 as *Ustilago iseilematis* Syd. & Butler). In ovaries of *Iseilema laxum*, Samalkota (Madras), Goribidanur (Mysore).]

S. mnesitheae Thirum. & Mundkur (**225**: 3). In inflorescences of *Mnesithea laevis*.

[**S. monilifera** (Ell. & Ev.) Clinton (**225**: 4; **135**: 112; Sacc. **XVII**: 487, **BB**: 51 as *Ustilago warneckeana* P. Henn.). In ovaries of *Heteropogon contortus*, Nandi Hills (Mysore); Walayar, Palghat, and N. Malabar (Madras).]

S. mutila Thirum. & Mundkur (**225**: 4). In ovaries of *Cymbopogon caesius*, Bangalore, Mysore.

[**S. pulverulenta** (Cooke & Massee) Ling (**72:** 127, **Sacc. IX:** 285, **BB:** 44 as *Cintractia pulverulenta* Cooke & Massee; **M:** 18 as *Ustilago pulverulenta* (Cooke & Massee) Cif.). On *Saccharum* sp., Nungklao, Khasi Hills.]

[**S. reiliana** (Kuehn) Clinton (**109:** 109; **Sacc. XVII:** 487; **BB:** 45 as *Sorosporium reilianum* (Kuehn) McAlp.). On Sorghum vulgare, India.]

[**S. rottboelliae** (Syd. & Butler) Mundkur (**98:** 111; **Sacc. XXI:** 499, **BB:** 50 as *Ustilago rottboelliae* Syd. & Butler). On *Hemarthria compressa*, Pusa.]

S. sacchari (Rabenh.) Ciferri (**102:** 211; **Sacc. VII:** 456 as *Ustilago sacchari* Rabenh.). On *Saccharum ciliare*, Calcutta; Kanpur; Muzaffarpur.

S. sahayai Mundkur (**98:** 93). On *Dichanthium annulatum*, Chatrapur, Ganjam Dt. (Orissa).

S. saccolepidis Thirum. (**216:** 173). In ovaries of *Saccolepis indica*, Bhadravati (Mysore).

S. schweinfurthiana (Thuem.) Sacc. (**66:** 253-54; **Sacc. XXI:** 509). On *Saccharum munja*, Biknathoree, Terrai.

S. stewartii Mundkur (**107:** 290). In ovaries of *Pennisetum flaccidum*. Baltistan (Kashmir), 9000 ft., Ladak Road (Kashmir), 9000 ft.

S. tenuis (Syd.) Zundel (**135:** 112; **Sacc. XXI:** 506, **BB:** 50 as *Ustilago tenuis* Syd.). On *Amphilophis pertusa*, Hunsur, Mysore.

[**S. tonglinensis** (Tracy & Earle) Zundel (**135:** 113; **Sacc. XIV:** 420, **BB:** 50 as *Ustilago tonglinensis* Tracy & Earle). In inflorescences of *Ischaemum* sp., Samalkota (Madras), Chatrapur, Ganjam (Orissa), Hoshangabad (M. P.); Incorrectly recorded in **BB:** 48 as *Ustilago burmanica* Syd. & Butler on *Ischaemum spathiflorum*, Bombay. According to Pavgi & Mundkur, re-examination shows that it is *Sphacelotheca tonglinensis.*]

S. vryburgii Zundel (**225:** 5). In spikelets destroying all the florets of *Themeda triandra*, Nandi Hills (Mysore).

S. žilligii Zundel (**225:** 5). In inflorescences of *Heteropogon contortus*, Nandi Hills, Mysore.

SPHAERODOTHIS (Sacc. & Syd.) Shear (**Sacc. XXIV:** 537) Asco., Dothideales (4).

S. borassi Ramakr. T. S. & K. (**157:** 74). On leaves of *Borassus flabellifer*, Coimbatore.

S. coimbatorica Ramakr. (**146a:** 162). On leaves of *Calamus rotang*, Anamalais.

SPHAEROPSIS Sacc. (**Sacc. III:** 291 as *Sphaeropsis* Lév. emend. Sacc.). Imp., Sphaeropsidales (1A2).

S. cycadis Mundkur & Ahmad (**110:** 9). On living leaves of *Cycas circinalis*, Rohtak, E. Punjab.

SPHAEROTHECA Lév. (**Sacc. I:** 3) Asco. Erysiphales (1).

S. lanestris Harkn. (**127:** 1; **Sacc. IX:** 364). On leaves of *Quercus incana*, Mussoorie, U.P., 6500 ft.

SPOROCYBE Fr. em. Bon. (**Sacc. IV:** 604) Imp., Moniliales (5A2).

S. hybrida Mason (**87:** 125). Isolated from roots of orange, Madras State.

STAGONOSPORA Sacc. (**Sacc. III:** 445) Imp., Sphaeropsidales (1C1).

S. brideliae Thirum. & Naras. (**217:** 71). On leaves of *Bridelia roxburghiana*, Nandi Hills, Mysore.

STEMPHYLIOMMA Sacc. & Trav. (**Sacc. XXII:** 1394) Imp., Moniliales (4C).

S. valparadisiacum (Speg.) Sacc. & Trav. (**170:** 334 as *S. valparadisiacum* Speg.; **Sacc. XXII:** 1394). On fruits of *Zizyphus jujuba*, Calcutta.

STEMPHYLIUM Wallr. (**Sacc. IV:** 519). Imp., Moniliales (4D).

S. ilicis Tengwall (?) (**64:** 276 as *Stemphyllium*). On leaves of *Livistona mauritiana*, Lucknow and Allahabad.

STEPHANOTHECA Syd. (**Sacc. XXIV:** 432) Asco., Hemisphaeriales (3).

S. oleae Hansf. & Thirum. (**61:** 303; **131:** 144). On leaves of *Olea dioica*, Balehonnur, Mysore; Khandala (Bombay).

STEREOGLOEOCYSTIDIUM (Rick) Rick in *Broteria*. 9 (36): 79. 1940. Basidio., Thelephoraceae.

[**S. spadiceum** (Fr.) Rick (**RS:** 18; **Sacc. VI:** 564, **BB:** 129 as *Stereum spadiceum* Fr.) On dead wood, Darjeeling; Sikkim.]

[S. **vibrans** (Berk. & Curt.) Rick (**RS:** 19; **Sacc. VI:** 577, **M:** 29 as *Stereum vibrans* Berk. & Curt.). On dead wood, Bengal.]

STICTIS Pers. ex Fr. (**Sacc. VIII:** 681) Asco., Phacidiales (1).

S. radiata (L.) Pers. (**9:** 11; **Sacc. VIII:** 682). On dead branches of *Sarcococca pruniformis*, Murree.

STILBOPHOMA Petrak in Bot. Arch., 43: 93. 1941. Imp., Sphaeropsidales.

S. microspora Petrak (**138:** 93). On palm leaves, Forest, Bombay.

STROBILOMYCES Berk. (**Sacc. VI:** 49). Basidio., Boletaceae.

S. kalimpongensis Bose (31: 80). On dead wood, Kalimpong (Bengal).

SYNCEPHALASTRUM Schroet. (**Sacc. VII:** 232) Phyco., Mucorales (5).

S. racemosum Cohn (**170:** 333-34 as *S. racemosum* (Cohn) Schroet.; **Sacc. VII:** 232). On fruits of *Nephelium litchi*, *Psidium guajava* and *Zizyphus jujuba*, Calcutta.

SYNCHYTRIUM de Bary & Woron. (**Sacc. VII:** 288) Phyco., Chytridiales (3).

[**S. aecidioides** (Peck) Lagerh. (**90:** 137; **Sacc. XXIV:** 17, **BB:** 2 as *Woroninella aecidioides* (Peck) Syd.). On leaves of *Amphicarpaea edgeworthii*, Simla.]

S. ajrekari Payak & Thirum. (**137:** 103). On leaves of *Phaseolus mungo*, Poona.

S. anemones (DC.) Woron. (**90:** 133; **Sacc. VII:** 288). On leaves of *Anemone* sp., Kashmir.

S. atylosiae (Petch) Gäumann (**90:** 133; **Sacc. XXI:** 759 as *Aecidium atylosiae* Petch). On leaves of *Atylosia* sp., Malleswaram, Mysore.

S. borreriae Lacy (**70:** 159). On leaves of *Borreria hispida*, Patna, Bihar.

S. crotalariae Ramakr. T. S. & K. (**157:** 67). On leaves and stems of *Crotalaria semperflorens*, Lovedale, Ootacamund (Nilgiris).

[**S. dolichi** (Cooke) Gäumann (**90:** 134; **Sacc. XXIV:** 17, **BB:** 2 as *Woroninella dolichi* Syd.). On leaves of *Dunbaria ferruginea*, Madras State,]

S. gei Padwick (**123:** 1; **90:** 134). On living leaves and petioles of *Geum alatum*, Aru, Kashmir, 11000 ft.

S. lagenariae Mhatre & Mundkur (**90:** 135). On leaves of *Lagenaria vulgaris*, Pusa, Bihar.

S. lepidagathidis Mundkur & Mhatre (**90:** 135). On leaves and stems of *Lepidagathis cristata*, Yeshwantpur (Mysore); *Lepidagathis* sp., Dehra Dun; *Dicliptera* sp., Dehra Dun; *Peristrophe* sp., Pusa, Bihar; Baijinath (Punjab); *Justicia procumbens*, Pusa, Bihar; *Justicia* sp., Aitampudi, Madras; Nagpur, M.P., Samalkota, Madras.

S. nyctanthidis Lacy (**70:** 160). On leaves of *Nyctanthes arbor-tristis*, Patna, Bihar.

S. phaseoli Patel, Kulkarni & Dhande (**133:** 171). On *Phaseolus mungo*, Jalagaon (Bombay). But see *S. phaseoli* Weston. 1930.

S. piperi Mundkur & Mhatre (**90:** 136). On leaves of *Piper betle*, Sassona, Alibag (Bombay).

[**S. puerariae** (P. Henn.) Miyabe (**90:** 137). **Sacc. XXI:** 839 as *S. peurariae* Miyabe; **BB:** 2 as *Woroninella puerariae* Syd.). On leaves and stems of *Pueraria hirsuta* and *P.* sp., India.]

S. sesamicola Lacy (**70**: 157). On stems and petioles of *Sesamum indicum*, Patna, Bihar.

S. stereospermi Lacy (**70**: 155). On leaves of *Stereospermum suaveolens*, Patna, Bihar.

S. trichosanthidis Mhatre & Mundkur (**90**: 136). On leaves, stems and fruits of *Trichosanthes dioica*, Pusa (Bihar); on leaves of *Citrullus vulgaris*, Pusa (Bihar); on leaves and stems of *Cephalandra* sp., Pusa.

S. vulgatum Rytz (**90**: 137; Sacc. **XXI**: 842). On leaves of *Launaea asplenifolia*, Pusa, Bihar; on leaves and stems of *Conyza* sp., Saranath, U.P.

TAPHRINA Fr. (Sacc. **VIII**: 812) Asco., Taphrinales (2).

T. linearis H. & P. Syd. (**217**: 73; Sacc. **XXIV**: 1303). On leaves of *Globba bulbifera* (as *G. marantina*), Lakkavalli, Mysore.

[**T. populina** Fr. (**96**: 37; **BB**: 9 as *T. aurea* (Pers.) Fr.). On leaves of *Populus ciliata*, Murree.]

TERMITOMYCES Heim in *Arch. Mus. Hist. nat. Paris*, Ser. 6, **18**: 147. 1942. Basidio., Agaricales.

[**T. microcarpus** (Berk. & Br.) Heim (**RS**: 139; Sacc. **V**: 687, **BB**: 93 as *Entoloma microcarpum* Berk. & Br.). Growing from old termite nests or soil, Bengal.]

THECAPHORA Fingerh. (Sacc. **VII**: 507) Basidio., Ustilaginales (1).

T. fimbristylidis Mundkur & Thirum., see *T. mauritiana*.

T. mauritiana (Syd.) Ling (**73**: 80; **115**: 4 as *T. fimbristylidis* Mundkur & Thirum.). In spikes of *Fimbristylis monostachya*, Bettahalli and Bangalore (Mysore).

THYRIDARIA Sacc. (Sacc. **II**: 140) Asco., Sphaeriales (C2).

T. incrustans Sacc. (**9**: 11; Sacc. **II**: 140). On dead branches of *Salvadora oleoides*, Rohtak, E. Punjab.

TILLETIA Tul. (Sacc. **VII**: 481) Basidio., Ustilaginales (2).

T. ahmadiana Pavgi & Mundkur (**135**: 113). On *Perotis indica* (as *P. latifolia*), Jaggatpur, Gurdaspur (E. Punjab).

T. ajrekari Mundkur (**98**: 103). On *Pennisetum typhoides*, in experimental plots, Ahmedabad.

T. brachypodii Mundkur, see *Neovossia brachypodii*.

T. eleusines Syd. (**98**: 101). On *Dactyloctenium aegyptium*, Pusa (Bihar), Coimbatore (Madars). The record in **M**: 18 is from Sialkot & Lahore which are now in Pakistan.

[**T. foetida** (Wallr.) Liro (**109**: 109;**108**: 52; **BB**: 46 as *T. foetans*. In ovaries of *Triticum vulgare*, New Delhi.]

T. koeleriae Mundkur (**108**: 52). In ovaries of *Koeleria cristata*, Simla.

T. narayanaraoana Thirum. & Mundkur (**225**: 6; **136**: 191). In ovaries of *Panicum trypheron*, Yeshwantpur, Mysore; Benares.

T. panici Mundkur, see *T. vittata*.

T. pennisetina Syd. (**108**: 52). In ovaries of *Pennisetum orrientale*, Simla.

[**T. vittata** (Berk.) Mundkur (**100**: 312; **124**: 6; **72**: 123; **100**: 317 as *T. panici* Mundkur; Sacc. **VII**: 459, **BB**: 51 as *Ustilago vittata* Berk.). In ovaries of *Oplismenus compositus*, Parasnath (4000 ft.), Bihar; Lawsinghi Ghat, Vizagapatam (Madras); Dehra Dun, U. P.; Nainital, U. P. The smut collected by Bagchee (in ovaries of *Panicum* sp., Calcutta) and reported as *T. ayresii* Berk. in **M**: 17 was later described by Mundkur (**100**: 317) as a

U. macrosperma (Cooke) Magn. (158: 103 as *Urediniopsis*). On leaves of *Pteridium aquilinum*, Anamalais.

UREDO Pers. (Sacc. VII: 838) Basidio., Uredinales (form genus).

U. amomi Petch (152: 44; Sacc. XXIII: 948). On leaves of *Amomum* sp., Valparai, Anamalais.

U. callicarpae Petch (218: 230; Sacc. XXIII: 948). On leaves of *Callicarpa lanata*, Kemmangudi, Mysore.

U. carissae Thirum. (218: 230). On leaves of *Carissa* sp., Kemmangudi, Mysore.

U. celastri Arthur & Cummins (203: 246). On leaves of *Celastrus paniculata*, Nandi Hills, Mysore.

U. chasaliae Petch (203: 246; Sacc. XXI: 798). On leaves of *Chasalia curviflora*, Balehonnur, Mysore.

U. elettariae Thirum. (196: 232). On *Elettaria cardamomum*, Balehonnur, Mysore.

U. malabarica Ramakr. T. S. & K. (156: 55). On leaves of *Bridelia retusa*, Walayar (Malabar).

U. neilgherriensis Ramakr. (144: 45). On leaves of *Parthenocissus neilgheriensis*, Kodaikanal.

U. ophiorhizae Petch (203: 246; Sacc. XXIII: 945). On leaves of *Ophiorhiza brunonis*, Kemmangudi and Balehonnur, Mysore.

U. schuteriae Ramakr. (144: 44). On leaves of *Schuteria vestita*, Kodaikanal.

U. terminaliae-paniculatae Ramakr. T. S. & K. (156: 56). On leaves of *Terminalia paniculata*, Walayar, Malabar, Madras.

UROCYSTIS Rabenh. (Sacc. VII: 515) Basidio., Ustilaginales (2).

U. caricinoides (Berk. & Curt.) Fischer (108: 52; Sacc. VII: 520). On stems and petioles of *Cimcifuga foetida*, Kashmir

U. colchici-lutei Zundel (247: 411). On *Colchicum luteum*, India.

U. oryzopsidis Padwick & Khan (126: 1). On leaves of *Oryzopsis munroi*, near Pahalgam, Kashmir, 7300 ft.

U. poae (Liro) Padwick & Khan (126: 2). On leaves of *Poa* spp., Aru, Kashmir, 8600 ft.

U. stipae McAlpine (107: 292; Sacc. XXI: 525). On *Stipa sibirica*, Sonamarg, Sind Valley, Kashmir, 9000 ft.

U. tritici Koern. (108: 52; Sacc. XXI: 526). On *Triticum vulgare*, Madhya Pradesh. Recorded in BB: 52 from Lyallpur which is now in Pakistan.

UROMYCES Link (Sacc. VII: 531) Basidio., Uredinales (2).

U. acori Ramakr. & Rang. (160: 240; Sacc. XVI: 357, BB: 78 as *Uredo acori* Racib.) On leaves of *Acorus calamus*, Ootacamund, Nilgiris.

U. dolicholi Arthur (131: 146; Sacc. XXI: 539). On leaves of *Rhynchosia minima*, Kirkee, Bombay.

U. haussknechtii Tranz. (44: 457; Sacc. XXI: 560). On *Euphorbia pilosa*, above Gadsar.

U. kondoi M. Miura? (44: 457). On *Gueldenstaedtia* probably new sp., near *multiflora*, Rawalpindi.

U. lapponicus Lagerh. (44: 458; Sacc. IX: 292). On *Astragalus maddenianus*, Burzil Pass.

U. loculiformis Ramakr. T. S. & K. (153: 66). On leaves of *Chlorophytum attenuatum*, Coonoor, Nilgiris.

U. lycoctoni (Kalchbr.) Trotter (44: 458). On *Aconitum laeve*. near *Gulmarg*; below Kun Patthar.

U. nilagiricus Ramakr. T. S. & K. (158: 104). On leaves of *Loranthus* sp., on *Citrus reticulata*, Kotagiri, Nilgiris.

U. orthosiphonis Ramakr. & Sriniv. (164: 26). On leaves of *Orthosiphon glabratus*, Nilgiris.

U. piauhyensis P. Henn. (157: 77; Sacc. **XXI**: 569). On leaves of *Wedelia urticaefolia*, Perur, Coimbatore.

U. proeminens (DC.) Pass. (44: 458). On *Euphorbia hispida*, Titwal.

U. sojae (P. Henn.) Syd. (146a: 162; Sacc. **XXI**: 539). On leaves of *Glycine max*, Agr. Res. Sta., Palur, S. Arcot, Madras.

U. triandrae Ramakr. & Sriniv. (164: 25). On leaves of *Themeda triandra*, Burliar, Nilgiris.

U. wedeliae-biflorae (Syd.). Boedijn (**RS**: 30: Sacc. **XXI**: 796, **BB**: 80 as *Uredo wedeliae-biflorae* (Syd.). On leaves of *Wedelia urticaefolia*, Palghar, Bombay.

U. wellingtonica Ramakr. T. S. & K. (153: 66). On leaves of *Sporobolus indicus*, Wellington, Nilgiris.

USTILAGINOIDEA Bref. (Sacc. **XIV**: 431) Imp., Moniliales (4A).

[**U. burkilli** (Syd. & Butler) Thirum. & Mundkur (215: 170; Sacc. **XXIII**: 607, **BB**: 48 as *Ustilago burkilli* Syd. & Butler). In ovaries of *Aneilema nudiflorum*, Gauripur, Mymensingh; Bangalore.]

USTILAGO (Pers.) Roussel. (Sacc. **VII**: 451). Basidio., Ustilaginales (1).

U. ahmadiana Syd. (185: 437). On *Polygonum rumicifolium*, Rotang Pass.

U. amphilophidis Zundel (247: 400). On *Amphilophis ischaemum*, India.

U. andropogonis-finitim Maublanc (108: 49; Sacc. **XXI**: 507 as *U. andropogonis-finitimi*). In ovaries of *Cymbopogon flexuosus*, Nandi Hills, Mysore.

U. barberi Mundkur (98: 98). On *Cymbopogon coloratus*, Palamcotta, Tinnevelly, Madras.

U. cordai Liro (107: 288). On *Polygonum* sp., Kangan-Gund, Kashmir, 6000 ft.

U. courtoisii Ciferri (102: 210). On *Saccharum arundinaceum*, Bolampatti; Tiruvadi (Madras).

[**U. crus-galli** Tracy & Earle (105: 632; Sacc. **XIV**: 421 as a synonym of *Cintractia crus-galli* (Tracy & Earle) Magn.). On *Echinochloa frumentacea*, Pusa, Bihar; on stems and nodes of *E. colona* (243: 329), Mysore and Mandya Dt. According to Mundkur (105: 632), the fungus recorded as *Ustilago panici-frumentacei* Bref. in **BB**: 50 is *U. crus-galli*.]

U. dehiscens Ling (72: 124). On *Polygonum amplexicaule*, Kashmir, 10000 ft.

U. euphorbiae Mundkur (100: 331). In fruits of *Euphorbia dracunculoides*, Kalashakaku, Punjab.

U. flagellata Syd. (108: 49; Sacc. **XXIII**: 613). In ovaries of *Rottboellia exaltata*, Anamalais, Madras.

U. hypodytes (Schlecht.) Fr. (185: 437; Sacc. **VII**: 453). On culms of *Oryzopsis lateralis*, Losar, Spiti.

U. imperatae Mundkur (108: 49). On *Imperata cylindrica*, Kohima, Naga Hills, Assam.

U. lachrymae-jobi Mundkur (100: 325). In ovaries of *Coix lachryma-jobi*, Girnar Hills, Junagadh.

U. longiflora Thirum & Mundkur (225: 2). In ovaries of *Digitaria longiflora*, Bangalore, Mysore.

[**U. maydis** (DC.) Corda (135: 115: Sacc. **VII**: 472; **109**: 109 as *U. mays-zeae* (DC.) Corda; **BB**: 51 as *U. zeae* (Beckm.) Unger). In inflorescence, leaves and culms of *Zea mays*, Harwan, Kashmir; Munsong, Darjeeling.]

U. morinae Padwick & Khan (126: 1). On inflorescence of *Morina longifolia*, near Aru, Kashmir, 11000 ft.

U. nepalensis Liro (185: 437). On *Polygonum punctatum* as *P. alatum*), Khanag.

U. neyraudiae Mundkur (100: 323). In ovaries of *Neyraudia arundinacea*, Dehra Dun, U.P.

U. macrosperma (Cooke) Magn. (158: 103 as *Urediniopsis*). On leaves of *Pteridium aquilinum*, Anamalais.

UREDO Pers. (Sacc. VII: 838) Basidio., Uredinales (form genus).

U. amomi Petch (152: 44; Sacc. XXIII: 948). On leaves of *Amomum* sp., Valparai, Anamalais.

U. callicarpae Petch (218: 230; Sacc. XXIII: 948). On leaves of *Callicarpa lanata*, Kemmangudi, Mysore.

U. carissae Thirum. (218: 230). On leaves of *Carissa* sp., Kemmangudi, Mysore.

U. celastri Arthur & Cummins (203: 246). On leaves of *Celastrus paniculata*, Nandi Hills, Mysore.

U. chasaliae Petch (203: 246; Sacc. XXI: 798). On leaves of *Chasalia curviflora*, Balehonnur, Mysore.

U. elettariae Thirum. (196: 232). On *Elettaria cardamomum*, Balehonnur, Mysore.

U. malabarica Ramakr. T. S. & K. (156: 55). On leaves of *Bridelia retusa*, Walayar (Malabar).

U. neilgherriensis Ramakr. (144: 45). On leaves of *Parthenocissus neilgheriensis*, Kodaikanal.

U. ophiorhizae Petch (203: 246; Sacc. XXIII: 945). On leaves of *Ophiorhiza brunonis*, Kemmangudi and Balehonnur, Mysore.

U. schuteriae Ramakr. (144: 44). On leaves of *Schuteria vestita*, Kodaikanal.

U. terminaliae-paniculatae Ramakr. T. S. & K. (156: 56). On leaves of *Terminalia paniculata*, Walayar, Malabar, Madras.

UROCYSTIS Rabenh. (Sacc. VII: 515) Basidio., Ustilaginales (2).

U. caricinoides (Berk. & Curt.) Fischer (108: 52; Sacc. VII: 520). On stems and petioles of *Cimcifuga foetida*, Kashmir

U. colchici-lutei Zundel (247: 411). On *Colchicum luteum*, India.

U. oryzopsidis Padwick & Khan (126: 1). On leaves of *Oryzopsis munroi*, near Pahalgam, Kashmir, 7300 ft.

U. poae (Liro) Padwick & Khan (126: 2). On leaves of *Poa* spp., Aru, Kashmir, 8600 ft.

U. stipae McAlpine (107: 292; Sacc. XXI: 525). On *Stipa sibirica*, Sonamarg, Sind Valley, Kashmir, 9000 ft.

U. tritici Koern. (108: 52; Sacc. XXI: 526). On *Triticum vulgare*, Madhya Pradesh. Recorded in BB: 52 from Lyallpur which is now in Pakistan.

UROMYCES Link (Sacc. VII: 531) Basidio., Uredinales (2).

U. acori Ramakr. & Rang. (160: 240; Sacc. XVI: 357, BB: 78 as *Uredo acori* Racib.) On leaves of *Acorus calamus*, Ootacamund, Nilgiris.

U. dolicholi Arthur (131: 146; Sacc. XXI: 539). On leaves of *Rhynchosia minima*, Kirkee, Bombay.

U. haussknechtii Tranz. (44: 457; Sacc. XXI: 560). On *Euphorbia pilosa*, above Gadsar.

U. kondoi M. Miura? (44: 457). On *Gueldenstaedtia* probably new sp., near *multiflora*, Rawalpindi.

U. lapponicus Lagerh. (44: 458; Sacc. IX: 292). On *Astragalus maddenianus*, Burzil Pass.

U. loculiformis Ramakr. T. S. & K. (153: 66). On leaves of *Chlorophytum attenuatum*, Coonoor, Nilgiris.

U. lycoctoni (Kalchbr.) Trotter (44: 458). On *Aconitum laeve*. near *Gulmarg;* below Kun Patthar.

U. nilagiricus Ramakr. T. S. & K. (158: 104). On leaves of *Loranthus* sp., on *Citrus reticulata*, Kotagiri, Nilgiris.

U. orthosiphonis Ramakr. & Sriniv. (**164:** 26). On leaves of *Orthosiphon glabratus,* Nilgiris.

U. piauhyensis P. Henn. (**157:** 77; **Sacc. XXI:** 569). On leaves of *Wedelia urticaefolia,* Perur, Coimbatore.

U. procminens (DC.) Pass. (**44:** 458). On *Euphorbia hispida,* Titwal.

U. sojae (P. Henn.) Syd. (**146a:** 162; **Sacc. XXI:** 539). On leaves of *Glycine max,* Agr. Res. Sta., Palur, S. Arcot, Madras.

U. triandrae Ramakr. & Sriniv. (**164:** 25). On leaves of *Themeda triandra,* Burliar, Nilgiris.

U. wedeliae-biflorae (Syd.). Boedijn (**RS:** 30; **Sacc. XXI:** 796, **BB:** 80 as *Uredo wedeliae-biflorae* (Syd.). On leaves of *Wedelia urticaefolia,* Palghar, Bombay.

U. wellingtonica Ramakr. T. S. & K. (**153:** 66). On leaves of *Sporobolus indicus,* Wellington, Nilgiris.

USTILAGINOIDEA Bref. (**Sacc. XIV:** 431) Imp., Moniliales (4A).

[**U. burkilli** (Syd. & Butler) Thirum. & Mundkur (**215:** 170; **Sacc. XXIII:** 607, **BB:** 48 as *Ustilago burkilli* Syd. & Butler). In ovaries of *Aneilema nudiflorum,* Gauripur, Mymensingh; Bangalore.]

USTILAGO (Pers.) Roussel. (**Sacc. VII:** 451). Basidio., Ustilaginales (1).

U. ahmadiana Syd. (**185:** 437). On *Polygonum rumicifolium,* Rotang Pass.

U. amphilophidis Zundel (**247:** 400). On *Amphilophis ischaemum,* India.

U. andropogonis-finitim Maublanc (**108:** 49; **Sacc. XXI:** 507 as *U. andropogonis-finitimi*). In ovaries of *Cymbopogon flexuosus,* Nandi Hills, Mysore.

U. barberi Mundkur (**98:** 98). On *Cymbopogon coloratus,* Palamcotta, Tinnevelly, Madras.

U. cordai Liro (**107:** 288). On *Polygonum* sp., Kangan-Gund, Kashmir, 6000 ft.

U. courtoisii Ciferri (**102:** 210). On *Saccharum arundinaceum,* Bolampatti; Tiruvadi (Madras).

[**U. crus-galli** Tracy & Earle (**105:** 632; **Sacc. XIV:** 421 as a synonym of *Cintractia crus-galli* (Tracy & Earle) Magn.). On *Echinochloa frumentacea,* Pusa, Bihar; on stems and nodes of *E. colona* (**243:** 329), Mysore and Mandya Dt. According to Mundkur (**105:** 632), the fungus recorded as *Ustilago panici-frumentacei* Bref. in **BB:** 50 is *U. crus-galli.*]

U. dehiscens Ling (**72:** 124). On *Polygonum amplexicaule,* Kashmir, 10000 ft.

U. euphorbiae Mundkur (**100:** 331). In fruits of *Euphorbia dracunculoides,* Kalashakaku, Punjab.

U. flagellata Syd. (**108:** 49; **Sacc. XXIII:** 613). In ovaries of *Rottboellia exaltata,* Anamalais, Madras.

U. hypodytes (Schlecht.) Fr. (**185:** 437; **Sacc. VII:** 453). On culms of *Oryzopsis lateralis,* Losar, Spiti.

U. imperatae Mundkur (**108:** 49). On *Imperata cylindrica,* Kohima, Naga Hills, Assam.

U. lachrymae-jobi Mundkur (**100:** 325). In ovaries of *Coix lachryma-jobi,* Girnar Hills, Junagadh.

U. longiflora Thirum & Mundkur (**225:** 2). In ovaries of *Digitaria longiflora,* Bangalore, Mysore.

[**U. maydis** (DC.) Corda (**135:** 115; **Sacc. VII:** 472; **109:** 109 as *U. mays-zeae* (DC.) Corda; **BB:** 51 as *U. zeae* (Beckm.) Unger). In inflorescence, leaves and culms of *Zea mays,* Harwan, Kashmir; Munsong, Darjeeling.]

U. morinae Padwick & Khan (**126:** 1). On inflorescence of *Morina longifolia,* near Aru, Kashmir, 11000 ft.

U. nepalensis Liro (**185:** 437). On *Polygonum punctatum* as *P. alatum*), Khanag.

U. neyraudiae Mundkur (**100:** 323). In ovaries of *Neyraudia arundinacea,* Dehra Dun, U.P.

[**U. parlatorei** Fisch. de Waldh. (**115**: 1 as *U. parlatorei*. Fisch. and Waldh; Sacc. **VII**: 474; **BB**: 49 as *U. goeppertiana* Schroet). On petioles and midribs of *Rumex* sp., Mussoorie, U.P.]

U. polytocae Mundkur (**98**: 118; **131**: 145). On *Chionachne koenigii* (as *Polytoca barbata*), Gosenhatti, Belgaum Dt., Bombay.

U. polytocae-barbatae Mundkur (**100**: 314). In ovaries of *Chionachne koenigii* (as *Polytoca barbata*), Sipna Valley, Amraoti.

U. punjabensis (Syd.) Ling (**73**: 76; **108**: 50 as *Ustilago tragi* Mundkur; **165**: 216 as *U. tragana* Zundel). In ovaries of *Tragus biflorus*, Coimbatore, Madras.

U. reticulata Liro (**107**: 289). On *Polygonum* sp., Pahalgam, Kashmir, 7300 ft.

U. scitaminea Syd. v. **sacchari-barberi** Mundkur (**99**: 529; **100**: 323; **136**: 191). On *Saccharum barberi*, Partabgarh; Amritsar; Karnal; Sepaya; on *S. officinarum*, Partabgarh; Amritsar; Karnal; Sepaya; Benares; on *S. spontaneum*, Pusa; Hoshangabad.

U. scitaminea Syd. v. **sacchari-officinarum** Mundkur (**99**: 530; **100**: 323). On *Saccharum officinarum*, Sambalpur, M.P.

U. shiraiana P. Henn. (**153**: 58; Sacc. **XVI**: 369). On shoots of *Arundinaria wightiana*, Ootacamund, Nilgiris.

U. stilags sparsa *Underur.* (**98**: 106; Sacc.) In ovaries of Dactylocknium asgyptium, Pusa.

U. sporoboli-tremuli Ramakr. T. S. & K. (153: 58). On shoots of *Sporobolus tremulus*, Chettipalayam, Coimbatore.

U. stewartii Zundel (**247**: 403). On *Rheum webbianum*, Usi Mar, Deosai Plains, Kashmir.

U. sydowiana Mundkur (**100**: 333). ≡ *Ustilago eleusines* Syd. nec Kulkarni. On *Dactyloctenium scindicum*, Punjab plains.

U. tragi Mundkur, see *U. punjabensis*.

[**U. tumeformis** Ling (**73**: 77; **BB**: 51 as *U. tuberculiformis* Syd.). On *Polygonum chinense*, Darjeeling. This collection was reported in **BB**: 51 as *U. tuberculiformis* Syd.]

U. valentula Syd. (**115**: 6). In ovaries of *Chloris bournei*, Neddungayam, Nilambur, Madras State.

VALSA Fr. (Sacc. **I**: 108) Asco., Sphaeriales (AA).

V. ceratophora Tul. (**123**: 3; Sacc. **I**: 108). On dead twigs of *Castanea* sp., Chaubattia, U.P.; on dead twigs of *Aesculus indica*, Chaubattia, U.P.

VALSARIA Ces. & de Not. (Sacc. **I**: 741 as *Valsaria* de Not. & Ces.) Asco., Sphaeriales (B2).

V. salvadorina Mundkur & Ahmad (**110**: 6). On bark and wood of *Salvadora oleoides*, Rohtak, E. Punjab.

VERTICILLIUM Nees ex Wallr. (Sacc. **IV**: 150) Imp., Moniliales (3A).

V. dahliae Klebahn (**131**: 149, without authority; Sacc. **XXV**: 706). On leaves, stems, etc. of *Dahlia* sp., *Datura fastuosa*, *Gossypium herbaceum*, *Hibiscus esculentus*, *Lycopersicon esculentum*, *Nicotiana tabacum*, *Physalis* sp., Poona; on *Solanum melongena* and *S. tuberosum*, Bombay.

WALLROTHIELLA Sacc. (Sacc. **I**: 455) Asco., Sphaeriales (A1).

W. bromeliae Rehm (**127**: 1; Sacc. **XVI**: 466). On leaves of *Ananas sativus*, Dangri, Assam.

XENOSTELE Syd. (Sacc. **XXIII**: 830) Basidio., Uredinales (2).

X. indica Thirum. (**208**: 27; **147**: 30, as *X. neolitseae* Ramakr. T. S. & K.) On leaves of *Neolitsea zeylanica*, Ootacamund, Nilgiris.

X. neolitseae Ramakr. T. S. & K., see *X. indica*.

XEROCOMUS Quel. (Sacc. **XX**: 1146) Basidio., Agaricales.

X. indicus Singer (**RS**: 248). India.

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ROSTROSPORA, A NEW GENUS OF THE MELANCONIALES

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ABSTRACT

Rostrospora gen, nov. is proposed as a new member of the Melanconiales, in the Fungi Imperfecti. It resembles *Colletotrichum* Corda, but differs from it in having conidia which are rostrate. The type of the genus is *Rostrospora ciliata* (Ramakrishnan, T. S. and K.) Subramanian and Ramakrishnan, comb nov. (Syn. *Colletotrichum ciliatum* Ramakrishnan, T. S. and K.).

Colletotrichum ciliatum was described by T. S. and K. Ramakrishnan (1947, p. 185) on *Cymbopogon polyneuros* Stapf., from the Nilgiris. The fungus was described as having one-celled, apically uniciliate, hyaline conidia. Since in other details the fungus agreed with the genus *Colletotrichum*, it was described as a species of that genus.

We were able to examine the type specimen of this fungus through the kindness of Mr. T. S. Ramakrishnan, Government Mycologist, Coimbatore, who sent us a fragment of it. There is little to alter in the description given by T. S. and K. Ramakrishnan. However, the description of the conidium as "ciliate" does not seem to be appropriate. To us it appears more appropriate to describe the conidium as "rostrate".

The genus *Colletotrichum* as at present understood includes species having (1) cylindrical conidia with rounded ends, and (2) fusoid, curved conidia with pointed ends (Duke, 1928). So far as we are aware, ciliate or rostrate conidia have not so far been described for any species of this genus other than *C. ciliatum*. According to Duke (1928, p. 165) the type species of *Colletotrichum* Corda i.e. *C. lineola* Corda "is characterised by fusiform, curved, acute, hyaline spores."

The type method is now largely advocated and followed in taxonomic studies on fungi. Adherence to the type method does not recommend inclusion in the genus *Colletotrichum* Corda of a fungus having conidia very much different from that of the type species. Since *C. ciliatum* differs from the type species *C. lineola* in having conidia with a prominent rostrate tip, it has to be removed from the genus *Colletotrichum*. So far as we are aware this fungus cannot appropriately be placed in any other genus. It is, therefore, proposed to establish a new genus for this fungus. The name *Rostrospora* is chosen to indicate the rostrate nature of the conidia.

Rostrospora Subramanian and Ramakrishnan, gen. nov. Fungus imperfectus, Melanconiales, resembling *Colletotrichum*. Acervuli with dark, septate, thick-walled, pointed or blunt setae; conidia produced on conidiophores, acrogenous, hyaline, one-celled, with a rostrate tip.

Type species: **Rostrospora ciliata** (Ramakrishnan, T. S. and K.) Subramanian and Ramakrishnan, comb. nov.

Pertinet ad Fungos Imperfectos, Melanconiales, atque proxime accedit ad genus *Colletotrichum*. Acervuli ornati setis, fuscis, crasse parietatis acutis vel obtusis; conidia insedentia conidiophoris, acrogena, hyalina, uni-cellulata, apice rostrato.

Species typica: *Rostrospora ciliata* (Ramakrishnan, T. S. and K.) Subramanian and Ramakrishnan, comb. nov. Synon. *Colletotrichum ciliatum* Ramakrishnan, T. S. and K., in *Proc. Indian Acad. Sci.* B., *25:* 185, 1947.

Acervuli amphigenous, more numerous on the upper surface, small, separate or coalescing to form compact linear groups between the parallel veins; setae thick-walled, often wavy below, broader and darker at the base, paler towards the apex which is pointed or blunt, septate, 43-115 × 5-10 μ; conidiophores arising from a sub- or intra-epidermal stroma composed of pseudoparenchymatous somewhat brownish, thin-walled cells, hyaline, thin-walled, short, cylindrical; conidia one-celled, hyaline, thin-walled, slightly curved, with a prominent, straight, thin, pointed beak at the upper end, 20-40 × 3·6-5·4 μ.

Hab. on living leaves of *Cymbopogon polyneuros* Stapf., Nanjanad (Nilgiris) (Type), Coll. T. S. Ramakrishnan, September, 1946, (Herb. M.U.B.L. No. 442).

We thank Sri. T. S. Ramakrishnan, Government Mycologist, Coimbatore, for kindly placing a fragment of the type at our disposal and the Rev. Fr. H. Santapau, Professor of Botany, St. Xavier's College, Bombay, for kindly rendering the diagnosis into Latin.

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FOOD AND FEEDING HABITS OF *PENAEUS INDICUS* M. ED.

BY

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(Accepted for publication April, 21, 1952)

ABSTRACT

The stomach contents of 380 specimens of *Penaeus indicus* have been analysed with a view to study the food habits of the animal.

Although vegetable matter and crustaceans form the bulk of the food items, the presence of other animal matter indicates an omnivorous habit.

A few experimental observations on feeding also have been made.

INTRODUCTION

Although the food of food fishes has received much attention, comparatively little is known of the feeding habits of the penaeid prawns, which are of considerable food value in many parts of India. Hence the present study was attempted in the hope that the results obtained would not only fill a gap in our knowledge of this group, but also prove valuable in the development of prawn fisheries.

References to the food of the penaeid prawns have been made by Chopra (1939) and Panikkar (1952). The former author mentioned that the prawns "eat practically any food, living or dead, that comes their way". According to Panikkar, the food of young penaeids consists of organic detritus, algae, and minute organisms in the mud. Among those who made observations on the food of allied prawns, the following deserve mention. Hunt (1925) in the course of a study of the food of the bottom fauna of Plymouth fishery grounds found that the stomach contents of *Leander serratus* included fragments of small crustaceans, polychaetes, hydroids, polyzoans, and filamentous algae. Patwardhan (1937) in his memoir on *Palaemon* sp., the Indian river prawn, mentioned that its food consists of algae, moss, weeds, small insects and debris. Recently Forster (1951 a & b) analysed the stomach contents of two British prawns, *Leander serratus* Pennant, and *Leander*

squilla L., and showed that they are omnivorous, but algae and Crustacea are the most important food items.

Material and Methods

The prawns used for analysis of stomach contents were caught in the inshore waters of the Chepauk and Triplicane areas of the Madras coast, and brought to the laboratory as fresh as possible. They were identified, measured, and their stomachs dissected out to examine their contents. The percentages of the food components were estimated by spreading the stomach contents on an "E. R. Bogusch Measuring Slide".

For the sake of convenience the prawns studied were divided into the following length groups. Group I, length below 11 cms; Group II, length 11-14 cms.; Group III, length 14-17 cms.; and Group IV, length 17-20 cms.

Experimental observations on live prawns were also made. The specimens were kept in large glass troughs and in cement tanks, with the bottoms covered with sand, and different kinds of algae, pieces of fish muscles and lamellibranchs, and various planktonic organisms were regularly supplied to these. The observations on feeding were made continuously for a few days.

Analysis of Stomach Contents

Stomach contents of 380 prawns, collected during a period of twelve months have been analysed and the results obtained are presented in table I. It will be noted that they have been grouped under four headings, viz., digested matter and detritus, vegetable matter, crustacean matter and non-crustacean animal matter. Further identifications were rendered difficult in most instances on account of the fact that a great portion of the stomach contents were in a broken condition, due to the action of the powerful mandibles and the gastric armature. The animal matter has been classified as non-crustacean and crustacean items, since the latter not only formed the bulk, but also enabled an easier identification.

A general analysis of the stomach contents of *Penaeus indicus* is as follows:—

Vegetable matter. In many of the prawns used for this study, vegetable matter was present in good proportion. Fragments of different types of algae were common food items, and a few plank-

TABLE I

APPROXIMATE PERCENTAGES OF THE FOOD COMPONENTS OF *PENAEUS INDICUS*

Length group	Month	No. of Specimens examined	Digested matter and detritus	Vegetable matter	Animal matter	
					Crustaceans	Non-Crustaceans
I (length below 11 cms.)	Aug.	12	22	30	25	23
	Sep.	9	47	23	18	12
	Oct.	10	35	24	30	11
	Nov.	9	16	31	38	15
	Dec.	10	40	45	9	6
	Jan.	Nil	—	—	—	—
	Feb.	13	35	23	11	31
	Mar.	12	32	13	30	25
	Apr.	10	12	42	27	19
	May	7	17	35	40	8
	Jun.	12	45	17	28	10
	Jul.	8	24	32	27	17
II (length 11-14 cms.)	Aug.	9	32	27	22	19
	Sep.	Nil	—	—	—	—
	Oct.	8	21	33	30	16
	Nov.	11	37	29	20	14
	Dec.	7	56	17	12	15
	Jan.	14	13	10	17	60
	Feb.	Nil	—	—	—	—
	Mar.	10	24	32	28	16
	Apr.	10	16	54	18	12
	May	10	13	18	53	16
	Jun.	7	43	22	25	10
	Jul.	10	17	41	26	16

Length group	Month	No. of Specimens examined	Digested matter and detritus	Vegetable matter	Animal matter	
					Crustaceans	Non-Crustaceans
III (length 14-17 cms.)	Aug.	11	28	9	29	34
	Sep.	6	20	14	37	29
	Oct.	7	19	35	26	20
	Nov.	4	13	57	25	5
	Dec.	6	59	20	7	14
	Jan.	3	2	8	23	67
	Feb.	9	15	10	19	56
	Mar.	8	20	33	31	16
	Apr.	9	42	12	33	13
	May	10	10	26	30	34
	Jun.	8	28	32	29	11
	Jul.	6	37	23	21	19
IV (length 17-20 cms.)	Aug.	10	30	14	27	29
	Sep.	7	15	25	32	28
	Oct.	5	51	21	17	11
	Nov.	6	36	27	23	14
	Dec.	10	25	51	11	13
	Jan.	8	35	3	22	40
	Feb.	7	20	24	15	41
	Mar.	8	39	28	20	13
	Apr.	10	9	17	38	36
	May	6	27	40	13	20
	Jun.	Nil	—	—	—	—
	Jul.	8	55	19	15	11

tonic algae like *Trichodesmium*, and diatoms like *Coscinodiscus*, *Pleurosigma* and *Rhizosolenia* were occasionally present and could be identified because they were not mutilated. Cuttings of sea weeds and small quantities of green matter were other items coming under this group.

Crustacean matter. Large quantities of appendages and body parts of crustaceans were invariably present in the stomachs of the prawns studied. Most of these appeared to be parts of small crustaceans like copepods, ostracods, amphipods, tiny decapods and also their larval stages.

Non-crustacean animal matter. On account of the partial digestion already undergone in the stomach, many items could not be identified definitely. The molluscan items present included shell pieces with or without body parts, a few unidentifiable young forms and larvae. Very few foraminiferans and polychaetes were met with. Occasional presence of parts of echinoderm larvae and hydroids was observed, and in some instances presence of living trematodes also was noted.

Digested matter and detritus. Forster (1951 a) prefers to give the term " Debris " to designate all unidentifiable portions of the stomach contents and considers that they are of slight food value only.

The presence of sand particles inside the stomachs was noticed in a few instances and these probably were taken in along with food items.

Experimental Observations

The feeding mechanism of *Palaemon* sp. has been observed by Patwardhan (1937) and the functions of the mouth parts of *Leander serratus* is known from the work of Borradaile (1917). In *Penaeus indicus* the feeding mechanism is similar to that in *Palaemon* sp. and hence only a few interesting points are mentioned here.

The prawns kept in the laboratory tanks consume different types of food materials like algae, planktonic organisms, muscle pieces, and polychaetes. They usually prefer small particles of food, which are grasped by the chelae of the walking legs and passed on to the mouth. When bigger articles are taken up, more than one leg, with or without the assistance of the third maxilliped, are used to catch hold of the prey.

The method of attacking and capturing small ctenophores and medusae is of interest. The walking legs hold the prey close to the mouth so that the mouth parts could act on it. The actual ingestion of the material is accomplished very slowly and sometimes the prawn lets off its hold to take up smaller food items available.

Even though many living forms were kept together for a number of days in the laboratory tanks, no instance of smaller prawns being attacked and killed by the bigger ones was noticed, even after starving them for days together. However, whenever an individual in the tank died or was about to die, it was immediately attacked by some of the living ones and eaten up.

Remarks

The analysis of stomach contents shows that no marked differences are seen regarding the nature of the food taken by prawns of different sizes studied. However, Forster (1951 a) has found that the food of young specimens of *Leander serratus* and *Leander squilla* less than 30 mm. length differs from that of larger specimens mainly in regard to the quantities of vegetable matter and crustaceans. In *Leander serratus,* the small specimens are found to feed mainly on crustaceans but only little of vegetable matter and in *Leander squilla* the condition is reversed. In the present work such a distinction in the length groups studied is not evident.

It will be noted from the table that vegetable matter is found to be present throughout the year in varied proportions. The amounts of crustacean and non-crustacean elements show periodic fluctuations, but there is no clear uniformity in these differences. So it is likely that these prawns feed on whatever suitable material they come across and such a wide adaptability in their feeding habits may be of importance in prawn cultures.

From observations made in the laboratory it seems likely that in a state of nature these prawns are partly predatory in habits and chase smaller creatures of a size which they can seize between their appendages. The larger crustaceans, fish and others are attacked only in a dead condition. The occurrence of molluscan shell pieces and detritus inside the stomach suggests a bottom feeding habit, but it is also likely that the molluscs might have been taken in along with the vegetable matter.

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THE EFFECT OF N'- AND O- ACYLATION ON THE PERIODATE OXIDATION OF HYDROXYLYSINE:

The Free Nature of the Functional Groups of Hydroxylysine in the Intact Protein

BY

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ABSTRACT

N'-benzoylation or O-acetylation effectively inhibits the periodate oxidation of hydroxylysine. As a group specific reagent periodic acid oxidises all the specific groups of hydroxylysine in intact gelatin, whereas benzoylation effectively masks these groups and prevents the oxidation by periodate. Based on these observations it is concluded that the functional groups on the δ and ε carbon atoms of hydroxylysine to gelatin are free and not bound.

As specific oxidants of invaluable use, both lead tetra-acetate and periodic acid are employed in the determination of the hydroxyamino acids, serine, threonine and hydroxylysine. That such compounds possessing the structure $RCHOH\text{-}CHNH_2R'$ are attacked by periodate, yielding ammonia and two aldehydes,

$$IO_4' + RCHOH\text{-}CHNH_2R' \rightarrow IO_3' + RCHO + R'CHO + NH_3$$

was discovered by Nicolet and Shinn (1939). Either the ammonia generated, the volatile aldehydes evolved or the amount of periodate consumed serve as an index of the hydroxyamino acid content. Though many of the other ∝-amino acids also are attacked by periodate, the rates of reaction in these cases are extremely low, at least a thousand times slower than the rates of oxidation of ∝-hydroxy acids, which themselves are not noticeably affected in the cold and only slowly even at elevated temperatures. The nature of these latter reactions, however, remain obscure due to lack of sufficient data.

The characteristic mode of oxidation of ∝-glycol and ∝-amino alcohols by periodic acid is, however, known to be profoundly affected by slight alterations in structure in the compounds con-

cerned by substitution, etc. Thus with increasing aromatic substitution the glycol molecules become less reactive towards periodic acid; some do not react at all (Palfray, Halasz & Rovira, 1940; Palfray & Halasz, 1937). Esterification of one or more of the alcohol groups in polyhydroxy acids is known to arrest the degradation process. In reactive compounds with the α-amino alcohol structure the amino group may be primary or secondary. The reaction has not been tested extensively on compounds with a secondary or tertiary group. Though oxidation might be expected to occur generally in the case of secondary amino derivatives, tertiary amino derivatives should not react (Jackson, 1944). However, acyl derivatives of serine have been reported to react extremely slowly, a result which suggests that acylated derivatives, -CHOH-CHNHCOR′-, generally may be stable in the presence of periodic acid.

In the light of the above it seemed interesting to examine the influence of substituents on the δ—OH and ε—NH_2 groups of hydroxylysine on the ability of periodic acid to oxidise the compound in the usual way. In view of the non-availability of the necessary amounts of pure hydroxylysine, samples containing a mixture of lysine and hydroxylysine only have been made use of. Because lysine is not affected by periodic acid under the experimental conditions, the observations made are unequivocal and retain their significance. The effect of periodic acid on a benzoylated sample of gelatin has also been studied. The implications of these results are discussed.

Experimental

For the preparation of the derivatives, the starting material was the lysine-hydroxylysine fraction prepared from catholytes obtained by electric transport of gelatin hydrolysates. The fraction was directly used for the preparation of the N′-benzoyl derivative, whereas for the O—acetyl derivative a sample of the mixed dihydrochlorides obtained from the above fraction has been made use of.

The extent of periodic acid oxidation of the acylated derivative in the mixed samples and the oxidation of the same after hydrolysis were measured by using one or both of the two methods given below:

The Alkaline Titration Procedure (*Van Slyke, Hiller and MacFadyen*, 1941)

The titrations were performed with 0.02 N arsenite solution which titrates an equal volume of 0.01 M $NaIO_4$. The arsenite

solution was made fresh before use by mixing 1 vol. of 0.1 M standard arsenite with 1.25 vol. of I M $NaHCO_3$ and diluting to 5 vol. with water.

For the titration, samples containing free hydroxylysine or its derivatives dissolved in a convenient volume of water were treated with an excess of 0.2 M HIO_4. To this was added 5ml 1 M $NaHCO_3$ and 1 ml 20% KI solution. Usually, when the bicarbonate is added, 1 mole periodate per mole of free hydroxylysine present is instantly reduced to iodate. To avoid the effects of secondary reactions an excess of the standard arsenite solution is added after the addition of the KI and the excess arsenite titrated against the standard iodine solution. From the observed amount of periodate consumed, the amount of hydroxylysine in the sample is calculated. If any of the derivatives are stable to periodic acid, no consumption of the reagent would be observed and the amount of hydroxylysine present in the sample is rated as nil.

The Periodate-ammonia method (Van Slyke et al, 1941): The method follows in close detail that of the original workers.

Several investigators have demonstrated that for hydroxyamino compounds acidity favours O-acylation, while alkalinity favours N-acylation. For the preparation of the N′-benzoyl derivatives of the amino acids in the lysine-hydroxylysine fraction, the amino acids were first converted into their copper salts and the same then benzoylated, the copper being later removed with H_2S. The O-acetylation has been performed following the details given by Sakami and Toennies (1942) for the acetylation of serine.

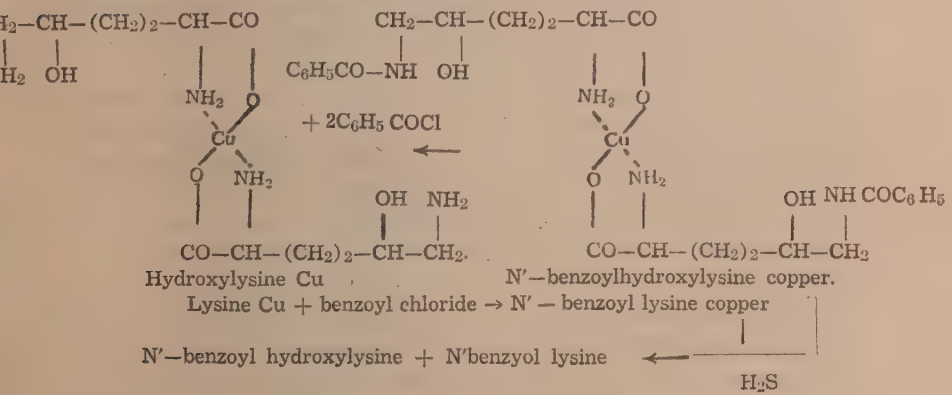
Preparation of the N′-benzoylated derivatives and the effect of such substitution on oxidisability.

100ml of a concentrated lysine-hydroxylysine fraction (equivalent to 150g. gelatin) was adjusted to pH 8.5 and excess copper phosphate was added, and set aside to stand for 6hr. at R. T. with frequent stirring. It was then filtered through a 3G4 sinter filter and washed till the filtrate gave a negative test for Cu. The filtrate was now treated with sufficient ION NaOH so as to make the solution 0.2 N with respect to NaOH. This was now cooled in a salt-ice bath and benzoyl chloride (15ml) added from a dropping funnel while the mixture was kept thoroughly agitated by a mechanical stirrer. The addition of the reagent took about 30 min, at the end of which there was some separation of the copper complex. Stirring was continued for another hour after which the alkalinity

was neutralised to give just a strong pink with phenolphthalein and refrigerated overnight to insure complete separation of any insoluble materials. The ppt was filtered off and washed with ice water till the washings were colourless. After two further washings with 95% alcohol the sample was dried in air.

The copper complex was suspended in water (20 ml/g) and decomposed with H_2S. The mixture was heated to boiling, filtered, the filtrate concentrated till crystallisation was evident, and then refrigerated. The well crystallised N′-benzoyl mixed derivatives were removed by filtration and dried by trituration with absolute alcohol and ether, whereby any yellow colour or benzoic acid present was completely removed. The residue was dried over H_2SO_4 in vacuo.

The above steps are represented in Chart I.



To study the effect of the above substitution, samples were analysed for their hydroxylysine content by the periodate oxidation method previous to hydrolysis of the N′-benzoyl linkage and other samples after hydrolysis. Sorensen and Anderson (1908) and Synge (1939) have shown that conditions of acid hydrolysis effect the cleavage of the N-acyl bond and alkaline hydrolysis that of the O-acyl bond. Two samples of the mixed derivatives were treated with periodic acid and the periodate consumption measured by the alkaline titration procedure. Absence of periodate consumption indicated absence of periodate oxidation. Two other samples were analysed for their hydroxylysine content by the same method but after preliminary hydrolysis (15 ml. 8 M. HCl/g. substance. Refluxing for 9·5 hr. pH adjusted to 6·5, made to volume and aliquots used).

The results are given below :

	% hydroxylysine derivative in the Mixed Sample	
	Prior to hydrolysis	*After hydrolysis*
1	0·165	7·08
2	0·155	7·08

In the case of the unhydrolysed sample there is scarcely any consumption of periodate, thereby indicating that benzoylation of the ε-amino group effectively inhibits the periodic acid oxidation of the amino acid under the usual conditions.

Preparation of the O-acetylated derivatives, and the effect of the O-acylation on periodate oxidation of the compound.

By approximately diluting conc. acqueous perchloric acid (60% A.R.) with acetic acid an aq. solution 0·6 M in $HClO_4$ and 1·7 M in water was prepared. 100 ml of this solution were added to a mixed dihydrochloride sample containing the equivalent of 50mM of hydroxylysine and then acetic anhydride first corresponding in amount equimolarly to the total water present and then, in addition, to a 40% excess over that required for O-acetylation. The acetic anhydride was gradually run into the solution, which was kept in a glass stoppered flask for about 1 hr. at R.T., in order to insure completion of acetylation. Thereupon 2 ml of water were added which under the prevailing conditions of acid catalysis would eliminate all remaining acetic anhydride. After leaving for an hour for the hydration of the acetic anhydride, 80mM of commercial amylamine were added to the solution with cooling. The amylamine and its perchlorate were removed by single extraction with chloroform. The pH was adjusted to neutral and aliquots analysed by the periodate ammonia method and the alkaline titration procedure. Aliquots to which sufficient alkali was now added to make the alkali concn. 1 N were allowed to stand at R.T. for 28 hr. This treatment achieves the hydrolysis of the O-acyl bond. The pH was again restored to neutral and analysed by both methods. The results are given below :

% Hydroxylysine derivative in the Mixed Sample

Method	*In the original dihydrochloride sample*	*After O-acylation*	*After hydrolysis of the O-acetyl linkage*
Alkaline titration	10·75	0·05	10·63
Periodate NH_3	10·82	nil	10·69

Here we observe that in the case of the O-acetylated derivative also there is neither any evolution of periodate NH_3 nor consumption of periodate on treatment with periodic acid, indicating thereby that the O-acylated hydroxylysine also is substantially stable towards periodic acid.

Effect of Benzoylation of Gelatin on Periodate Oxidation

Two one gram lots of gelatin dissolved in 10 ml. water, adjusted to be 0·1 N with respect to NaOH, kept cool in an ice bath were treated with 0·5 ml. benzoyl chloride with vigorous stirring of the contents. The reaction mixture was allowed to stand for 3 hrs. The pH was now adjusted to be 3-4 with acetic acid. A sticky mass began precipitating out. 200 ml. anhydrous methyl alcohol were now added, the vessel stoppered, and shaken vigorously for 20 min. The gritty dry mass left at the bottom was collected by centrifuging, washed twice with MeOH and redissolved in 10 ml. water with the aid of warming. Analysed for periodate ammonia by the method devised for intact proteins (Ramachandran, 1952). No periodate ammonia could be detected.

This indicates that benzoylation of gelatin effectively masks all the specific groups of hydroxylysine in gelatin. Unbenzoylated gelatine, as reported (Ramachandran, 1952) gives rise to periodate ammonia equivalent to 1·08% hydroxylysine N on total N.

Discussion

The results recorded above show that benzoylation of the intact protein (gelatin) effectively masks all the specific groups of hydroxylysine, inasmuch as no periodate ammonia could be detected on periodate treatment of such benzoylated gelatin. Under the alkaline conditions it is probably only N'-benzoylation that takes place. However, the results obtained indicate that either N'- or O-acylation alone is able to make the derivative almost completely stable to periodic acid. Since no loss of hydroxylysine is noted to occur during acid hydrolysis of gelatin (Ramachandran, 1952) and because no hydroxylysine is present in acid hydrolysates of periodate treated gelatin (Ramachandran and Sarma, 1952) it is to be concluded that treatment of gelatin with periodate leads to complete oxidation of all the specific groups of hydroxylysine. These observations taken together, therefore, indicate that in the intact gelatin the ε-amino group of hydroxylysine is not of a secondary nature, i.e. the amino group cannot be linked up to give branch chains or in other ways, and that the δ-OH group

of the amino acid in the intact protein, also, cannot be engaged in any form of firm bondage. Thus the functional groups on the δ- and ε-carbon atoms of hydroxylysine are free in the intact gelatin. Therefore one has to consider the generalisation (Neurath, Greenstein, Putnam and Erickson, 1945) regarding the side chain polar groups of the pure, native protein being, in general, strikingly and unexpectedly inert towards specific reagents for these groups as too sweeping (Martin & Synge, 1945). It does not seem to hold true at least in the case of the side chain polar groups of hydroxylysine in gelatin. Also, there is considerable evidence (Gurin & Clarke, 1934; Linderstorm-Lang, 1933; Porter & Sanger, 1948) indicating that the ε-amino groups of the related lysine residues in proteins are generally free.

It was indicated that substitution of the reactive hydrogen atoms in either the ε-amino or δ-OH group effectively inhibits the periodic acid oxidation of hydroxylysine. This is against the general observation, alluded to earlier, that compounds with a secondary amino group would generally be expected to get oxidised. Taken along with Nicolet et al's observation (1939, 1942) on acylated serine, the present results force upon us the conclusion that acylated derivatives of hydroxyamino acids are generally stable in the presence of periodic acid.

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STUDIES ON THE INTER-RELATIONSHIP AMONG VITAMINS AND AMINO-ACIDS

Invitro studies of the Influence of Desoxy-pyridoxine on the conversion of Tryptophane to Nicotinic acid

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Abstract

In the studies on the inter-relationship among vitamins and amino-acids, it has been shown using the anti-vitamin of vitamin B_6 — desoxy-pyridoxine — in the case of the rat and cattle liver slices that pyridoxine added as well as the pyridoxine already present influences the biosynthesis of nicotinic acid. These results are in general agreement with similar results obtained with rats as well as with germinating seedlings.

Further in the cattle liver the D isomer of tryptophane is not utilised but also aappears to inhibit the conversion of tryptophane to nicotinic acid.

Introduction

Krehl, Sarma, Teply and Elvehjem (1945) showed for the first time that rats deficient in nicotinic acid would grow well if tryptophane is given and soon afterwards Rosen, Huff and Perlzweig (1946) demonstrated an increased excretion of nicotinic acid derivatives in the urine of rats to which tryptophane has been administered. These results aroused wide-spread interest and numerous confirmatory observations have appeared in rapid succession showing that tryptophane is the dietary precursor of nicotinic acid derivatives in the rat (Rosen *et al.* 1946), horse (Schweigert, Pearson and Wilkening 1947), pig (Luecke, McMillen, Throp and Tull 1947), dog (Singal, Sydenstricker and Little John 1947) and man (Sarett and Goldsmith 1947). The scope of the study has been further widened by other investigators to include plant and micro-organisms. Thus, it has been shown that in the case of the fungus *Neurospora* (Mitchell and Nyc 1948) and the rat (Heidelberger 1949) that tryptophane serves as nicotinic acid precursor by way of Kynurenine and 3 hydroxy anthranailic acid. Several observations were made on the various factors affecting this inter-relationship between tryptophane and nicotinic acid especially the influence of the B group of vitamins (Porter and Clark, 1948).

Studies by Schweigert and Pearson (1947) and Rosen et al (1947) demonstrated that vitamin B_6 deficient rats and mice in contrast to animals receiving an edequate quantity of the vitamin excrete small amounts of nicotinic acid and its derivatives when tryptophane is fed. Pyridoxine deficiency also decreases the conversion of Kynurenine to nicotinic acid (Rosen et al 1947, and Henderson, Weinstock and Ramasarma 1951). Shanmuga Sundaram, Ranganathan and Sarma (1951) have shown that even in the case of germinated seedlings vitamin B_6 is influencing the conversion of tryptophane to nicotinic acid. They showed that desoxypyridoxine, the specific inhibitor for pyridoxine exerts a deleterious effect on the biosynthesis of nicotinic acid when present in the medium during germination. The effect was however nuetralised by the addition of excess quantities of pyridoxine in the medium indicating that Vitamin B_6 is concerned in the biosynthesis of nicotinic acid. Liver slices have been known to produce nicotinic acid from tryptophane and further the liver slices of pyridoxine deficient rats have been shown to produce much less quantities of nicotinic acid from tryptophane (Hurt, Scheer and Deuel 1949). *invitro* studies were therefore undertaken with liver slices of the rat and cattle in order to study the influence of desoxy-pyridoxine the anti-vitamin of the vitamin B_6 on the conversion of tryptophane to nicotinic acid. This investigation was also a logical sequence to the observation made with germinated pulses by Shanmuga Sundaram *et al.* (1951).

Experimental

The livers of the rat and cattle were taken out as soon as they were killed and kept cooled in ice. The slices were prepared in the following manner. A piece of filter-paper was placed in one corner of a frosted microscope slide and moistened with saline. The piece of tissue to be sliced (1 to 2 cm. diam.) was then placed on the filter paper. Another frosted slide was dipped in saline and applied to the top of the piece of tissue with gentle pressure and hold in place with one hand. The razor blade was moistened with saline and closely applied to the undersurface of the frosted microscope slide. The thickness and uniformity of the slice can be readily appreciated by the appearance of the slice through the microscope slide. The slice was transferred to a Petri dish containing physiological saline. The slices were handled by means of a pair of fine but blunt ended forceps. While transferring the slices to the weighing bottle, they were dried gently by means of a piece

of filter paper. The weighed slices were carefully transferred to a 50·0 ml boiling tube containing 5 or 10 ml M/5 phosphate buffer, pH 7·0 with necessary substrates. The boiling tubes were loosely plugged and incubated at 37°C for the required period. After incubation, 10·0 ml of 3N sulphuric acid was added and hydrolysed in an autoclave for 45 minutes at 15 pounds pressure. The slices were ground well and the solution made up to 50·0 ml.

Estimation of total nicotinic acid :

Both the chemical and micro-biological methods were used. In the chemical method the nicotinic acid was determined colorimetrically using lead acetate and zinc sulphate for deprotenisation and measuring the colour produced with cyanogen bromide and aniline according to the method of Hawk, Oser and Summerson (1947). In the microbiological assay the test organism used is a pure culture of *Lactobacillus arabinosus* (17-5). Any inhibitory effect of the small amount of desoxy-pyridoxine present in the solution was counteracted by adding excess pyridoxine in the basal medium. The basal medium has the following composition.

Acid hydrolysed casein	.. 0·5%
L (—) tryptophane	.. 0·01%
L (—) cystine	.. 0·02%
Adenine, Guanine and Uracil (each)	.. 10·0 p.p.m.
D (+) glucose	.. 2·0%
Sodium acetate	.. 2·0%
Thiamine, PABA, Calcuim-pantothenate (each)	.. 0·10 p.p.m.
Riboflavin	.. 0·20 p.p.m.
Biotin	.. 0·20 p.p.b.
Pyridoxine	.. 2·0 p.p.m.
Inorganic salts A and B (each)	.. 0·5 ml.

The estimations were carried out according to the method of Snell and Wright (1941).

Results and discussion :

The results obtained with the rat and cattle liver slices are presented in tables I and II respectively. From these tables it is seen that in the case of both the rat and cattle livers, the nicotinic acid content increases on an average of 30 to 50% on incubation without any tryptophane in the medium. With the addition of tryptophane to the medium there is greater synthesis of nicotinic acid. The presence of pyridoxine along with tryptophane increases significantly the nicotinic acid synthesis showing that added

TABLE I

RAT LIVER SLICES

Results are expressed in gamma per gm. of wet weight. Initial Nicotinic acid in fresh liver 88·0 gamma per gm.

No.	Substances used in the medium	Series I		Series II		Series III	
		Chemical method	Micro-biological method	Chemical method	Micro-biological method	Chemical method	Micro-biological method
1.	9 ml. buffer *plus* 0·5 mg. of desoxypyridoxine in 1 ml. water ..	133·6	140·6	118·1	122·3	115·8	120·6
2.	10 ml. of buffer alone ..	148·2	155·4	128·8	131·8	127·1	129·9
3.	20 mg. 1 tryptophane in 2 ml. water *plus* 8 ml. buffer	186·6	187·8	150·0	155·1	151·2	149·8
4.	20 mg. 1 tryptophane in 2 ml. water *plus* 2·5 mg. of B_6 in 1 ml. water *plus* 7 ml. buffer ..	193·0	197·6	161·3	164·7	159·4	160·8
5.	20 mg. 1 tryptophane in 2 ml. water *plus* 0·5 mg. of desoxypyridoxine in 1 ml. water *plus* 7 ml. buffer	157·8	160·4	159·4	160·8	131·2	129·6
6.	20 mg. 1 tryptophane in 2 ml. water *plus* 0·5 mg. of desoxypyridoxine in 1 ml. water *plus* 2·5 mg. of B_6 in 1 ml. water *plus* 6 ml. of buffer ..	179·3	182·8	142·3	145·4	149·0	147·2

(period of incubation = 18 hours)

TABLE II

CATTLE LIVER SLICES

Results are expressed in gamma per gm. of wet weight

No.	Substances in the medium	Series I Initial nicotinic acid in liver 54·6 gamma per gm.		Series II Initial nicotinic acid in liver 52·8 gamma per gm.		Series III Initial nicotinic acid 49·2 gamma per gm.
		Chemical method	Micro-biological method	Chemical method	Micro-biological method	Chemical method
1.	9·0 ml. buffer *plus* 1 mg. desoxy-pyridoxine in 1 ml. water	67·2	71·3	56·4	62·8	51·2
2.	10·0 ml. buffer alone ..	77·5	83·6	67·0	75·0	59·8
3.	10·0 mg. 1 tryptophane in - ml. water *plus* 9 ml. buffer ..	104·8	115·2	85·3	94·7	70·1
4.	10·0 mg. 1 tryptophane in 1 ml. water *plus* 10 mg. pyridoxine in 2 ml. water *plus* 7 ml. buffer ..	112·0	123·2	90·0	98·0	72·5
5.	10·0 mg. of 1 tryptophane in 1 ml. water *plus* desoxy-pyridoxine in 1 ml. water *plus* 8 ml. buffer ..	66·2	70·6	59·4	56·6	50·2
6.	10·0 mg. of 1 tryptophane in 1 ml. water *plus* 1 mg. of desoxy-pyridoxine in 1 ml. water *plus* 10 mg. of pyridoxine in 2 ml. water *plus* 6 ml. water ..	102·1	109·3	84·6	88·0	69·0

7.	10·0 mg. of *dl* tryptophane in 1 ml. water *plus* 1 mg. buffer ..	85·0	88·4	72·5	76·2	62·1
8.	10·0 mg. of *dl* tryptophane in 1 ml. water *plus* 1 mg. of desoxy-pyridoxine in 1 ml. water *plus* 8 ml. water ..	61·8	66·6	54·8	51·0	50·8
9.	10·0 mg. of *dl* tryptophane in 1 ml. water *plus* 1 mg. water *plus* 1 mg. of desoxy-pyridoxine in 1 ml. water *plus* 10 mg. of pyridoxine in 2 ml. water, *plus* 6 ml. buffer ..	78·0	80·4	70·2	72·0	62·5
10.	10·0 mg. of *dl* tryptophane in 1 ml. water *plus* 10·0 mg. of pyridoxine in 2 ml. water *plus* 7·0 ml. buffer ..	76·1	84·8	72·8	77·4	63·6
11.	20·0 mg. of *dl* tryptophane *plus* 10 ml. buffer ..	83·0	85·2	69·8	75·0	63·2
12.	20·0 mg. of *dl* tryptophane *plus* 10·0 mg. of pydidoxine in 2 ml. water *plus* 8 ml. buffer. ..	80·2	83·0	70·0	74·0	66·4
13.	20·0 mg. of *dl* tryptophane *plus* 1 mg. of desoxy-pyridoxine in 1 ml. water *plus* 9·0 ml. buffer..	65·9	70·4	61·5	59·0	51·3
14.	20·0 mg. of *dl* tryptophane *plus* 1 mg. of desoxy-pyridoxine in 1 ml. water *plus* 10·0 mg. of pyridoxine in 2 ml. water *plus* 7 ml. buffer ..	76·4	82·8	70·2	68·4	62·1

Period of incubation : 18 hrs.

pyridoxine influences the synthesis of this vitamin. When desoxy-pyridoxine is present in the medium, the nicotinic acid synthesis lowers considerably, in the media with and without tryptophane. The deleterious effect of desoxy-pyridoxine is counteracted by excess quantities of pyridoxine, indicating that pyridoxine is influencing the biosynthesis of nicotinic acid, a conclusion which is in confirmation with earlier observations with germinating seedlings by Shanmuga Sundaram *et al.* (1951). Further, it will be seen that in the case of the cattle liver slices there is greater synthesis of nicotinic acid only with the L-isomer of tryptophane. When DL tryptophane is used the synthesis increases, if at all, only to a slight extent. This seems to suggest that the D-isomer of tryptophane is not only not utilised but also is somewhat inhibitory. It is known that the liver and kidney of mammals contain the enzyme " D-amino acid oxidase " (Krebs 1935), which oxidises the D form of the amino acids first to a keto acid which is subsequently converted into the L form. (Horowitz 1944). Birkofer and Wetzel (1940) suggest that in general the highest concentration of this enzyme is found in carnivorous, the lowest in herbivorous and intermediate in omnivorous species, but more figures are needed before this statement can be accepted as generally valid. From the above observation it is clear, however, that the utilization of the D form of tryptophane or its influence necessarily depends on the " D amino-acid oxidase " present in the various species of animals. Further studies extending these and related observations in the case of liver slices of the cattle, rat and rabbit and germinating seedlings and the influence of other factors such as the various carbohydrates and other amino acids are in progress and will be published elsewhere.

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A NOTE ON THE MOMENTS OF A FUNCTION OF 'RUN LENGTHS'

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1. INTRODUCTION

Let n_1 black points and n_2 white points be arranged randomly on a straight line. This arrangement results in a series of black and white runs. (A run is defined as a succession of points of one kind preceded and followed by a point of the second kind). Let i denote the length of a run, N_{bi} and N_{wi}, the number of black and white runs respectively, of length i, and N_b, and N_w, the total number of black and white runs respectively, in an arrangement. It can be easily seen that

$$\sum_i N_{bi} = N_b \; ; \; \sum_i i\, N_{bi} = n_1 \; ;$$

$$\sum_i N_{wi} = N_w \; ; \; \sum_i i\, N_{wi} = n_2 \; ;$$

$$| N_b - N_w | \leqslant 1. \qquad .. \quad (1)$$

For example, in fig. 1, if b and w represent a black and a white point,

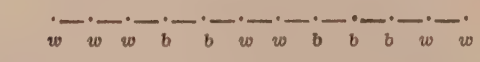

Fig. 1

$$n_1 = 5 \; ; \; n_2 = 7 \; ; \; N_b = 2 \; ; \; N_w = 3 \; ;$$
$$N_{b2} = 1 \; ; \; N_{b3} = 1 \; ; \; N_{w2} = 2 \; ; \; N_{w3} = 1.$$

Mood (1940) and Krishna Iyer (1948) have studied exhaustively the distribution of runs of a given length for two, as well as for k kinds of points. Wald and Wolfowitz (1940) derived the distribution of U, the total number of runs in a random arrange-

ment of points of two kinds and used it for a non-parametric test for two samples. The Wald-Wolfowitz test was modified by the present author (1951) by combining the range in run lengths with the number of runs, in a criterion to test whether two samples are drawn from the same population.

In this paper, the sum of squares of lengths of all the runs, viz.,

$$N = \sum_i i^2 N_{bi} + \sum_i i^2 N_{wi},$$

is used as a criterion to discriminate between various run patterns.* (A pattern exhibiting a large variation in lengths of runs will give a correspondingly large value for the sum of squares). The first two moments of the distribution of the statistic, N, have been derived for the particular case $n_1 = n_2 \ (= n)$. The expressions for the higher order moments are being investigated and it is hoped that it will be possible to publish them in a later issue of the journal.

2. The Moments of the Distribution of N.

Mood (1940) has derived the following expressions for the means and the second order moments of the distribution of N_{xi} $(x = b, w)$

$$E(N_{bi}) = E(N_{wi}) = \frac{(n+1)^{(2)} n^{(i)}}{(2n)^{(i+1)}}$$

$$E(N^2_{bi}) = E(N^2_{wi}) = \frac{n^{(2)} (n+1)^{(2)} n^{(2i)}}{(2n)^{(2i+2)}} + \frac{(n+1)^{(2)} n^{(i)}}{(2n)^{(i+1)}}$$

$$E(N_{bi} N_{bj}) = E(N_{wi} N_{wj}) = \frac{n^{(2)} (n+1)^{(2)} n^{(i+j)}}{(2n)^{(i+j+2)}}$$

* The statistic N may be used as follows to test whether two samples of equal size, are from the same population. The values of the two samples can be considered as points of two different colours. Thus we have a run pattern if the sample values are arranged in ascending order of magnitude. A run pattern with smaller variation in lengths of runs, may be considered more favourable to the null hypothesis.

$$E(N_{bi}\ N_{wj}) = \frac{n^{(i+2)}n^{(j+2)}}{(2n)^{(i+j+2)}} + \frac{4\,n^{(i+1)}\,n^{(j+1)}}{(2n)^{(i+j+1)}} + \frac{2\,n^{(i)}\,n^{(j)}}{(2n)^{(i+j)}} \quad .. \quad (2)$$

where $n^{(a)} = n(n-1)\ldots\ldots(n-a+1)$

In deriving the first two moments of N, we need employ only these expressions, since with each arrangement, the values of N_{bi}, N_{wi} alone change, for a given i. The first order moment of N is given by

$$E(N) = E(\sum_i i^2 N_{bi} + \sum_i i^2 N_{wi})$$

$$= E(1^2 N_{b1} + 2^2 N_{b2} + \ldots\ldots + n^2 N_{bn} + 1^2 N_{w1} + \ldots\ldots + n^2 N_{wn})$$

$$= \sum_{i=1}^{n} i^2 E(N_{bi}) + \sum_{i=1}^{n} i^2 E(N_{wi})$$

Substituting the expressions for $E(N_{bi})$ and $E(N_{wi})$ from (2), we have

$$E(N) = 2(n+1)^{(2)} \sum_{i=1}^{n} \frac{i^2 n^{(i)}}{(2n)^{(i+1)}} \quad .. \quad (3)$$

The expression for the second order moment about the origin, can similarly be obtained. Thus

$$E(N^2) = E(\sum_i i^2 N_{bi} + \sum_i i^2 N_{wi})^2$$

$$= E(\sum_i i^2 N_{bi})^2 + E(\sum_i i^2 N_{wi})^2 + 2E(\sum_i i^2 N_{bi})\,(\sum_i i^2 N_{wi})$$

$$= 2 \sum_{i=1}^{n} i^4 E(N^2_{bi})$$

$$+2\sum_{i\neq j=1}^{n} i^2 j^2 \,\mathrm{E}(N_{bi}\,N_{bj})$$

$$+2\sum_{i,\,j=1}^{n} i^2 j^2 \,\mathrm{E}(N_{bi}\,N_{wj})$$

$$=2(n+1)^{(2)}\sum_{i=1}^{n} i^4\,\frac{n^{(i)}}{(2n)^{(i+1)}}$$

$$+2n^{(2)}(n+1)^{(2)}\sum_{i,\,j=1}^{n}\frac{i^2 j^2\, n^{(i+j)}}{(2n)^{(i+j+2)}}$$

$$+2\left\{2\sum_{i,\,j=1}^{n} i^2 j^2\,\frac{n^{(i)}n^{(j)}}{(2n)^{(i+j)}}\right.$$

$$+4\sum_{i,\,j=1}^{n} i^2 j^2\,\frac{n^{(i+1)}n^{(j+1)}}{(2n)^{(i+j+1)}}$$

$$\left.+\sum_{i,\,j=1}^{n} i^2 j^2\,\frac{n^{(i+2)}n^{(j+2)}}{(2n)^{(i+j+2)}}\right\} \qquad \ldots\ (4)$$

The summation in (3) can be simplified. For,

$$\sum_{i=1}^{n} i^2\frac{n^{(i)}}{(2n)^{(i+1)}}=\frac{1}{(2n)\,C_{(n)}}\sum_{i=1}^{n} i^2\frac{(2n-i-1)!}{n!\,(n-i)!}$$

$$=\frac{1}{(2n)\,C_{(n)}}\sum_{a=o}^{n-1}(n-a)^2\frac{(n+a-1)!}{n!\,a!} \qquad \ldots\ (5)$$

where $a=(n-i)$.

Writing $(n-a)^2=n^2-a(2n-1)+a^{(2)}$, and using the identity

$\sum_{a=o}^{n}(a+r)\,C_{(a)}=(r+n+1)C_{(n)}$* we have,

* This can be obtained as follows:—

$$\begin{aligned}(r+n+1)\,C(n) &= (r+n)\,C(n)+(r+n)\,C(n-1).\\ &= (r+n)\,C(n)+(r+n-1)\,C(n-1).+\\ &\qquad (r+n-1)\,C(n-2)\\ &\qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\\ &= (r+n)\,C(n)+(r+n-1)\,C(n-1)+\\ &\qquad \ldots\ldots+(r+1)\,C(o)\\ &= \sum_{a=0}^{n}(r+a)\,C(a)\end{aligned}$$

since $(r+1)\,C(o)=(r)\,C(o)$.

$$\sum_{a=0}^{n-1} \frac{(a+n-1)!}{a!\ n!} = \frac{1}{n}[(2n-1)\ C_{(n-1)}]$$

$$\sum_{a=0}^{n-1} a\,\frac{(a+n-1)!}{a!\ n!} = (2n-1)\,C_{(n-2)}$$

and $$\sum_{a=0}^{n-1} a^{(2)}\frac{(a+n-1)!}{a!\ n!} = (n+1)\ [(2n-1)\ C_{(n-3)}]$$

Substitution in (5) gives

$$\sum_{i=1}^{n} i^2 \frac{n^{(i)}}{(2n)^{(i+1)}} = \frac{3n^2}{(n+2)^{(3)}}$$

Hence

$$E(N) = 2(n+1)^{(2)}\ \frac{3n^2}{(n+2)^{(3)}}$$

$$= \frac{6n^2}{(n+2)}$$

Similarly, by writing

$$(n-a)^4 = n^4 - (2n-1)(2n^2-2n+1)a + (6n^2-12n+7)\ a^{(2)} - 2(2n-3)a^{(3)} + a^{(4)}$$

and proceeding as before, the first term in (4) is found to be equal to

$$2(n+1)^{(2)}\ \left(\frac{n^4}{2n} - (4n^3-6n^2+4n-1)\frac{(n-1)}{2(n+1)} + \frac{(6n^2-12n+7)\ (n-1)^{(2)}}{2(n+2)}\right.$$

$$-\frac{2(2n-3)(n-1)^{(3)}}{2(n+3)}+\frac{(n-1)^{(4)}}{2(n+4)}\Bigg).$$

which reduces to $\dfrac{30n^3(5n-1)}{(n+4)^{(3)}}$ .. (7).

The second term consists of a double sum, which has to be evaluated in two stages. Putting $i=(n-a)$ and $j=(n-b)$,

$$\sum_{i,\,j=1}^{n} i^2 j^2 \frac{n^{(i+j)}}{(2n)^{(i+j+2)}}$$

$$=\frac{1}{(2n)\,C_{(n)}}\sum_{a,\,b=0}^{n-1}(n-a)^2(n-b)^2\frac{(a+b-2)!}{(a+b-n)!\,n!}$$

Now,

$$(n-a)^2=b^2-(2b-1)(a+b-n)+(a+b-n)^{(2)}$$

Summation with respect to a gives

$$\sum_{a,\,b=0}^{n-1}(n-a)^2(n-b)^2\frac{(a+b-2)!}{(a+b-n)!\,n!}$$

$$=\frac{1}{n}\sum_{b=0}^{n-1}(b+n-2)\,C_{(n-1)}$$

$$[2b^2+3b(n-1)+(n-1)^2](n-b)^2$$

which can be written as

$$\frac{1}{n}\sum_{b=0}^{n-1}(b+n-2)\,C_{(b-1)}$$

$$\cdot\ [2(b-1)^{(4)}-(n-17)(b-1)^{(3)}$$

$$-(3n^2+2n-33)(b-1)^{(2)}$$

$$+(n+1)(n^2-9n+12)(b-1)$$

$$+n(n^2-1)(n-1)]$$

Now summing this expression with respect to b, we have

$$\sum_{a,\,b=o}^{n-1} (n-a)^2 (n-b)^2 \frac{(a+b-2)!}{(a+b-n)!\,n!}$$

$$= (2n)\mathrm{C}_{(n)} \frac{2n^2(n-1)(9n^2-5n+4)}{(n+4)^{(3)}(n+1)^{(2)}n^{(2)}}$$

Hence the second term in (4) is equal to

$$\frac{2n^2(n-1)(9n^2-5n+4)}{(n+4)^{(3)}} \qquad .. \quad (8)$$

The third term in (4) is also evaluated on similar lines, but because of the complicated nature of the expressions, the details are omitted here. It will be seen that

$$\sum_{i,\,j=1}^{n} i^2 j^2 \frac{n^{(i)}n^{(j)}}{(2n)^{(i+j)}} = \frac{(36n^2+74n+28)}{(n+1)(n+2)}$$

$$- \frac{1}{(2n)\mathrm{C}_{(n)}} (n^4+4n^3+10n^2+16n+14)$$

$$\sum_{i,\,j=1}^{n} i^2 j^2 \frac{n^{(i+1)}n^{(j+1)}}{(2n)^{(i+j+1)}} = \frac{(18n^3-41n^2-149n-62)}{(n+1)(n+2)}$$

$$+ \frac{1}{(2n)\mathrm{C}_{(n)}} (n^4+4n^3+14n^2+28n+31)$$

$$\sum_{i,\,j=1}^{n} i^2 j^2 \frac{n^{(i+2)}n^{(j+2)}}{(2n)^{(i+j+2)}} = \frac{(18n^5-155n^4+221n^3+870n^2-56n-208)}{(2n-1)(n+1)(n+2)}$$

$$- \frac{1}{(2n)\mathrm{C}_{(n)}} (2n^4+8n^3+36n^2+80n+104) \qquad .. \quad (9)$$

Substituting (7), (8) and (9) in (4), and simplifying, we get

$$\mathrm{E}(\mathrm{N}^2) = 4\ \frac{(9n^6+66n^5+69n^4-62n^3-18n^2+200n+96)}{(n+4)^{(4)}} - \frac{16}{(2n)\mathrm{C}_{(n)}}$$

Hence

$$\text{Var. } (N) = E(N^2) - \frac{36n^4}{(n+2)^2}$$

$$= 8\,(6n^6 + 15n^5 - 16n^4 - 71n^3 + 82n^2 + 248n + 96) \Big/ (n+4)^{(4)}\,(n+2) - \frac{16}{(2n)\,C_{(n)}} \quad \ldots \quad (10)$$

For moderately large values of n, the second term in (10) is negligible and to $O\left(\frac{1}{n^2}\right)$ we have

$$E(N) = 6n.$$

$$\text{Var } (N) = \frac{24n\,(2n+5)}{(n+12)}$$

3. Remarks

A study of the frequency distribution of N, shows that for small values of n, (the number of black or white points), the frequency does not change in a 'regular' manner. For example, in frequency distribution for $n = 4$, given below there are large irregularities at $N = 14$ and 22. But when n increases, it has been found by studying the distributions in several cases, that the magnitude of the fluctuations diminishes. (The frequency distribution for $n = 8$, also is given below). This suggests that for moderately large values of n, the distribution of N can be approximated by a continuous function.

$n = 4$

N	Frequency	N	Frequency
8	2	22	0
10	6	24	2
12	18	26	4
14	6	28	0
16	14	30	0
18	8	32	2
20	8	Total	70

$n = 8$

N	Frequency	N	Frequency
16	2	74	28
18	14	76	42
20	98	78	12
22	210	80	32
24	534	82	8
26	660	84	16
28	992	86	0
30	1060	88	12
32	1232	90	16
34	908	92	0
36	1202	94	0
38	942	96	2
40	836	98	4
42	608	100	8
44	734	102	0
46	384	104	4
48	514	106	0
50	360	108	0
52	312	110	0
54	132	112	0
56	266	114	4
58	108	116	0
60	204	118	0
62	60	120	0
64	110	122	0
66	56	124	0
68	80	126	0
70	30	128	2
72	32		
		Total	12870

The asymptotic behaviour of the distribution cannot be studied in detail unless the higher order moments are derived. Their expressions are likely to be very complicated, but their values have been obtained for $n = 4$ to 8. The values of the coefficients β_1 and β_2, given below, show that both are steadily increasing with n and appear to be tending to some definite values. Since $\beta_1 > 0$ and $\beta_2 > 3$, normality cannot be assumed for large n.

n	β_1	β_2	k
4	1·149	4·111	— 0·912
5	1·579	5·014	— 2·333
6	1·834	5·859	10·450
7	1·976	6·322	3·089
8	2·041	6·600	2·150

The value of the Pearsonian criterion k suggests that the type VI function will prove a good fit for n larger than 5. The upper percentage points of the fitted distribution can be calculated from Catherine Thompson's Tables (1941), to facilitate the use of the statistic N to test whether two samples of the same size are drawn from the same population.

My grateful thanks are due to Dr. P. B. Patnaik for some valuable suggestions.

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A NOTE ON THE CORRELOGRAM OF THE GENERALISED MOVING AVERAGE

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1. *Introduction*

The correlogram of the time-series is used as a criterion for discriminating between various types of time-series generated by (a) moving averages, (b) the autoregressive scheme, (c) harmonic terms. Kendall (1) studied the correlogram of the series formed by the moving averages of a series of random elements. An attempt is made in this paper to study the correlogram of the series of moving averages of a series of elements which are not random but are correlated and also of 'difference' series.

2. *The correlogram of the series generated by the moving averages*

Suppose (U_t) $t = 1, 2, .. n$ is the time-series generated by the moving averages of (x_t) with weights $a_1, a_2, .. a_{m+1}$ and is given as

$$U_t = a_1 x_t + a_2 x_{t+1} + .. + a_{m+1} x_{t+m} \quad .. \quad (1)$$

Let us assume that the variables x_t are normal with mean zero and variance v and also that they are correlated. Let r_k be the serial correlation coefficient of lag k of the series (x_t). We shall find the lag correlation r'_k of the series (U_t) defined in (1).

Before proceeding with the general case let us consider the series (U_t) where

$$U_t = a_1 x_t + a_2 x_{t+1} \quad .. \quad (2)$$

and obtain an expression for the serial correlation r'_k.

$$E(U_t) = E(a_1 x_t + a_2 x_{t+1}) = 0.$$

$$E(U_t U_{t+k}) = E[(a_1 x_t + a_2 x_{t+1})(a_1 x_{t+k} + a_2 x_{t+k+1})]$$

$$= E[a_1^2 x_t x_{t+k} + a_1 a_2 (x_t x_{t+k+1} + x_{t+1} x_{t+k}) + a_2^2 x_{t+1} x_{t+k+1}]$$

$$= v[r_k (a_1^2 + a_2^2) + a_1 a_2 (r_{k+1} + r_{k-1})],$$

since $E(x_t x_{t+k}) = v$ if $k = 0$

$$= r_k v \text{ if } k \neq 0$$

Similarly $E(u_t^2) = E(a_1 x_t + a_2 x_{t+1})^2$

$$= E(a_1^2 x_t^2 + a_2^2 x_{t+1}^2 + 2a_1 a_2 x_t x_{t+1})$$

$$= v(a_1^2 + a_2^2 + 2a_1 a_2 r_1)$$

Thus the serial correlation of the series (2) is given as

$$r'_k = \frac{(a_1^2 + a_2^2) r_k + a_1 a_2 (r_{k+1} + r_{k-1})}{a_1^2 + a_2^2 + 2a_1 a_2 r_1} \quad \ldots \quad (3)$$

If $v_t = x_t - x_{t+1}$; $t = 1, 2, \ldots\ldots n,$ $\ldots \quad (4)$

the serial correlation coefficient r'_k of (4) the series of successive differences, is obtained from (3) by putting $a_1 = 1$, $a_2 = -1$. Thus

$$r'_k = \frac{2r_k - r_{k+1} - r_{k-1}}{2(1 - r_1)}$$ which expression is given by

Yule (1926).

The serial correlation r'_k of the series U_t defined in (1) is the generalisation of (3) when the moving average is taken over m terms. From (1) by writing $t + k$ for t, we get

$$U_{t+k} = a_1 x_{t+k} + a_2 x_{t+k+1} + \ldots\ldots + a_{m+1} x_{t+k+m}$$

Since $E(x_t) = 0$, we have $E(U_t) = 0$, $E(U_{t+k}) = 0$. Then the serial correlation coefficient r'_k is given by

$$r'_k = \frac{E(u_t u_{t+k})}{\sqrt{E(u^2_t)\ E(u^2_{t+k})}} \quad \ldots \quad (5)$$

To obtain (5), in terms of the correlations among the x's, let us evaluate the numerator and denomenator separately.

$$\mathrm{E}(u_t u_{t+k}) = \mathrm{E}\ (a_1 x_t + a_2 x_{t+1} + \ldots + a_m x_{t+m})\ (a_1 x_{t+k} + a_2 x_{t+k+1} + \ldots + a_{m+1} x_{t+k+m})$$

$$= \mathrm{E}\left(\sum_{i=0}^{m} a_1 a_{i+1}\, x_t x_{t+k+i} + \sum_{i=0}^{m} a_2 a_{i+1} x_{t+1} x_{t+k+i} + \sum_{i=0}^{m} a_3 a_{i+1}\, x_{t+2}\, x_{t+k+i} + \ldots\ldots\ldots + \sum_{i=0}^{m} a_m a_{i+1}\, x_{t+m-1}\, x_{t+k+i} + \sum_{i=0}^{m} a_{m+1}\, a_{i+1}\, x_{t+m}\ \ x_{t+k+i} \right)$$

$$= \mathrm{E}\left(\sum_{i=0}^{m} \sum_{j=0}^{m} a_{j+1}\, a_{i+1}\ x_{t+j}\ \ x_{t+k+i} \right)$$

$$= v\ \left(\sum_{i=0}^{m} a_1\, a_{i+1}\ r_{k+i} + \sum_{i=0}^{m} a_2 a_{i+1}\, r_{k+i-1} + \sum_{i=0}^{m} a_3 a_{i+1}\, r_{k+i-2} + \ldots\ldots\ldots\ldots + \sum_{i=0}^{m} a_m a_{i+1}\, r_{k+i-m+1} + \sum_{i=0}^{m} a_{m+1}\, a_{i+1}\, r_{k+i-m} \right)$$

$$= v\ \left(\sum_{i=0}^{m} \sum_{j=0}^{m} a_{i+1}\, a_{j+1}\, r_{k+i} \right) \qquad \ldots \quad (6)$$

The above expression (6) is rearranged and written as follows:

$$\mathrm{E}(u_t u_{t+k}) = v \left(\left(\sum_{i=1}^{m+1} a_i^2 \right) r_k + \left(\sum_{i=1}^{m} a_i a_{i+1} \right)\ (r_{k+1} + r_{k-1}) + \left(\sum_{i=1}^{m-1} a_i a_{i+2} \right) (r_{k+2} + r_{k-2}) + \ldots\ldots\ldots + \left(\sum_{i=1}^{2} a_i a_{m+i-1} \right) (r_{k+m-1} + r_{k-m+1}) + a_1 a_{m+1}\ (r_{k+m} + r_{k-m}) \right)$$

$$= v\ [A_{m+1}\, r_k + A_m (r_{k+1} + r_{k-1}) + A_{m-1} (r_{k+2} + r_{k-2}) +$$

$$\ldots\ldots + A_2\ (r_{k+m-1} + r_{k-m+1}) + A_1\ (r_{k+m} + r_{k-m})\ ]$$

where $A_{m-l+1} = \sum_{i=1}^{m+l+1} a_i\, a_{i+l}$ for $l = 0, 1, 2, \ldots m$ so that when $l = 0$, $A_{m+1} = \sum_{i=1}^{m+1} a_i^2$ and when $l = m$, $A_1 = a_1\, a_{m+1}$.

$$E(u_t^2) = E\,[a_1 x_t + a_2 x_{t+1} + a_{m+1}\, x_{t+m}]^2$$

$$= \Big(\sum_{i=1}^{m+1} a_i^2\Big)\, v + 2E\Big[\Big(\sum_{j=1}^{m} a_1 a_{i+1}\, x_t x_{t+i}\Big)$$

$$+ \Big(\sum_{i=1}^{m-1} a_2 a_{i+2}\, x_{t+1}\, x_{t+i+1}\Big) + \ldots\ldots\ldots +$$

$$+ \Big(\sum_{i=1}^{2} a_{m-1}\, a_{i+m}\, x_{t+m-2}\, x_{t+m+i-2}\Big) +$$

$$+ (a_m\, a_{m+1}\, x_{t+m-1}\, x_{t+m})\ ]$$

$$= v \Big(\sum_{i=1}^{m+1} a_i^2\Big) + 2v\ \Big[\sum_{i=1}^{m} a_1 a_{i+1}\, r_i + \sum_{i=1}^{m-1} a_2 a_{i+2}\, r_i$$

$$+ \ldots\ldots + \sum_{i=1}^{2} a_{m-1}\, a_{m+i-1}\, r_i + a_m\, a_{m+1}\, r_1\Big]$$

$$= v\ \Big[\Big(\sum_{i=1}^{m+1} a_i^2\Big)\Big] + 2v\ \Big[\Big(\sum_{i=1}^{m} a_i a_{i+1}\Big)\, r_1 + \Big(\sum_{i=1}^{m-1} a_i a_{i+2}\Big)\, r_2$$

$$+ \Big(\sum_{i=1}^{m-2} a_i a_{i+3}\Big)\, r_3 + \ldots\ldots\ldots + \ldots\ldots$$

$$+ \Big(\sum_{i=1}^{3} a_i a_{i+m-2}\Big)\, r_{m-2} + \Big(\sum_{i=1}^{2} a_i a_{i+m-1}\Big)\, r_{m-1}$$

$$+ a_1 a_{m+1}\, r_m\Big]. \qquad \ldots\ (7)$$

Hence the serial correlation coefficient r'_k of lag k of the series (1) is

$$r'_k = \frac{A_{m+1}\, r_k + A_m (r_{k+1} + r_{k-1}) + A_{m-1} (r_{k-2} + r_{k-2}) + \ldots\ldots + A_1\ (r_{k+m} + r_{k-m})}{A_{m+1} + 2\ [A_m r_1 + A_{m-1}\, r_2 + \ldots\ldots + A_2 r_{m-1} + A_1 r_m]} \qquad \ldots\ (8)$$

When the series (1) is a simple moving average of x'_ts with all the weights $a_1, a_2, \ldots . a_{m+1}$ equal to $\frac{1}{m+1}$ we have

$$r'_r = \frac{(m+1)r_k + m\,(r_{k+1}+r_{k-1}) + (m-1)\,(r_{k+2}+r_{k-2} + \ldots . + (r_{k+m}+r_{k-m})}{(m+1)+2\,[mr_1+(m-1)r_2+\ldots .+2r_{m-1}+r_m]}$$

If the moving average series consists of independent random elements with weights $a_1, a_2, \ldots . a_{m+1}$, then all the serial correlations r_k will vanish and its correlogram will be

$$r'_k = \frac{A_{m-k+1}}{A_{m+1}}$$

$$= \frac{\sum_{i=1}^{m-k+1} a_i a_{i+k}}{\sum_{i=1}^{m+1} a_i^2} \qquad \ldots \quad (9)$$

Kendall obtained (9) when all the weights are equal to $\frac{1}{m+1}$ and had shown

$$r'_k = \frac{m+1-k}{m+1} = 1 - \frac{k}{m+1}$$

In this case the correlogram of the series generated by the moving average consists of a straight line joining the points (0, 1) to (k, 0) together with the x-axis from the latter point onwards. In the case of general coefficients as in (9), we expect the correlogram to come down to the base line and coincide with it after a certain k.

3. *The Correlogram of the Difference Series*

If we choose the coefficients as $a_{m+1} = mc_0$, $a_m = -mc_1$; $a_{m-1} = mc_2$, .. $a_1 = (-1)^m mc_m$ and substitute in (1), we have

$$u_t = mc_0\, x_{t+m} - mc_1\, x_{t+m-1} + \ldots . + (-1)^m\, mc_m\, x_t \quad \ldots \quad (10)$$

which is the m^{th} difference series of x_t and is denoted by $\triangle^m x_t$. Then the serial correlation coefficient of lag k of the m^{th} difference series of x_t is obtained from (8) by substituting A_1, A_2..... Thus

$$r'_k = \frac{\sum_{i=0}^{m} c_i^2 - \sum_{i=0}^{m-1} c_i c_{i+1}(r_{k+1} + r_{k-1}) + \ldots + (-1)^{m-1} c_i c_{i+m-1}(r_{k+m-1} + r_{k-m+1}) + (-1)^m c_o c_m (r_{k+m} + r_{k-m})}{\sum_{i=0}^{m} c_i^2 - 2[(\sum_{i=0}^{m-1} c_i c_{i+1})\, r_1 + \ldots + (-1)^m c_o c_m r_m]}$$

where c_t is mc_i. But $c_o c_k + c_1 c_{k+1} + \ldots + c_{m-k} c_m$ is the coefficient of x^{m-k} in $(1+x)^{2m}$, i.e. $2m\, c_{m-k}$. Thus

$$r'_k = \frac{2mc_m r_k - 2mc_{m-1}(r_{k+1} + r_{k-1}) + \ldots + (-1)^m 2mc_o (r_{k+m} + r_{k-m})}{2mc_m - 2[2mc_{m-1} r_1 - 2mc_{m-2} r_2 + \ldots + (-1)^{m-1} r_m]}$$

$$= \frac{(-1)^m \triangle^{2m} r_{-(m-k)}}{2mc_m - 2\,[2mc_{m-1} r_1 - 2mc_{m-2} r_2 + \ldots + (-1)^{m-1} r_m]} \qquad (11)$$

When the series x_t is a series of random elements having all its correlations zero, the serial correlation r'_k of the m^{th} differences of random series is given as

$$r'_k = \frac{\sum_{i=1}^{m-k+1} a_i a_{i+k}}{\sum_{i=1}^{m+1} a_i^2}$$

$$= \frac{(-1)^k [c_o c_k + c_1 c_{k+1} + \ldots + c_m c_{m-k}]}{c_o^2 + c_1^2 + \ldots + c_m^2}$$

$$= \frac{(-1)^k\, 2mc_{m-k}}{2mc_m} \qquad .. \quad (12)$$

In particular, we have for the difference series

$$r'_1 = \frac{-2mc_{m-1}}{2mc_m} = -\frac{m}{m-1}$$

$$r'_2 = \frac{+2mc_{m-2}}{2mc_m} - \frac{m(m-1)}{(m+1)(m+2)}$$

$$r'_m = (-1)^m \frac{2mc_o}{2mc_m} = (-1)^m \frac{m(m-1)\ldots.2\cdot1}{(m+1)(m+2)\ldots.2m} \quad \ldots (13)$$

These results were derived by a different method by K. R. Nair (2).

I wish to express my thanks to Prof. P. B. Patnaik for his suggestions in the investigation of this problem.

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THE THEORY OF PROBABILITY DISTRIBUTION OF POINTS ON A CIRCLE

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1. Introduction

Consider a set of n points of two different characters, n_1 of one kind and n_2 of another, $(n_1 + n_2 = n)$, distributed evenly on the circumference of a circle. The characters can, for convenience, be described as colours, black and white. These black and white points can be distributed in a number of ways.

We define two adjacent black points as a black-black join, two adjacent white points as a white-white join, and two adjacent points of the two different colours as a black-white join. 's' adjacent points of the same colour may be defined as an s-plet.

Probability distribution of points on a straight line and on a lattice have been exhaustively studied by Wishart and Hirschfeld (1936), Stevens (1939), Mood (1940), Wald and Wolfowitz (1940), Krishna Iyer (1948) and Todd (1940), Finney (1947), Moran (1947), Krishna Iyer (1949), B. V. Sukhatme (1949) respectively and it has been suggested that they may be used to investigate the randomness of the occurrence and spread of a disease in an agricultural field. Kermack and McKendrick (1937) have studied the distributions of a randomly arranged set of unequal numbers on a straight line and a circle. Stevens (1939) has investigated the probability distribution of black-white joins on a straight line and a circle.

In this paper, the first four moments for the distribution of black-white joins (by a different approach) as well as for the distributions of black-black joins, white-white joins, triplets

and quadruplets, have been derived, both for free and non-free sampling.* A study of the nature of these distributions with the help of Pearson's criterion $\frac{\beta_1 (\beta_2 + 3)^2}{4 (4\beta_2 - 3\beta_1) (2\beta_2 - 3\beta_1 - 6)}$ shows that all these distributions follow the Pearson Type IV curve and in the limiting case when the number of points, n, becomes indefinitely large, they approach the Type VII form. (The actual proof of this is not given here).

The author has since been able to derive the actual distributions of black-black and white-white joins.

2. Distribution of the Total Number of Black — White Joins

Free Sampling :

Let the points be denoted by $x_1, x_2, \ldots\ldots x_n$. Obviously, since the points are arranged on a circle, $x_{i+n} = x_i$. Let $x_i = 1$ or O according as the point is black or white. It follows that if p is the chance that a point is black, $E(x_i) = p$ and $E(x_i x_j) = E(x_i) E(x_j)$ because of independence and hence $= p^2$. The total number of black-white joins is given by the special function

$$F_1 = \sum_{i=1}^{n} (x_{i+1} - x_i)^2 = \sum_{i=1}^{n} l_i \text{ (say)} \ldots\ldots\ldots (2\cdot1)$$

The moments of the distribution about the origin are obtained as follows :

$$F_1 = \sum_{i=1}^{n} x^2_{i+1} + \sum_{i=1}^{n} x^2_i - 2 \sum_{i=1}^{n} x_i x_{i+1}.$$

$$\mu'_1 = E(F_1) = np + np - 2np^2 = 2npq \quad \ldots\ldots (2\cdot2)$$

* Mahalanobis (1944) introduces the concepts of free and non-free sampling. Free sampling is the process in which the colour of each point is determined independently of all other points. n is fixed but n_1 and n_2 can vary (with the restriction $n_1 + n_2 = n$). The probabilities of a point being black and white are given by p and q $(= 1 - p)$ respectively. In non-free sampling, the total number of points in each category is fixed in advance and we are not at liberty to change the composition n_1 and n_2 are fixed and $n_1 + n_2 = n$

$$\mu'_2 = \mathrm{E}(\mathrm{F}_1^2) = \mathrm{E}[\sum_{i=1}^{n} l_i)^2] = \mathrm{E}[l_i^2 + 2\Sigma l_i l_{i+1} + 2\Sigma\Sigma_{i=j} l_i l_j]$$

Hence $\mu'_2 = 4npq + 4n(n-3)p^2q^2$ .. (2·3)

because $\mathrm{E}(l_i^2) = 2pq$, $\mathrm{E}(l_i l_{i+1}) = pq$ and $\mathrm{E}(l_i l_j) = 4p^2q^2$. Proceeding on similar lines, we find

$$\mu'_3 = 8npq + 24n(n-3)p^2q^2 + 8n(n-4)(n-5)p^3q^3 \quad .. \quad (2\cdot4)$$

and

$$\mu'_4 = 16npq + 112n(n-3)p^2q^2 + 96n(n-4)(n-5)p^3q^3 + 16n(n-5)(n-6)(n-7)p^4q^4 \quad .. \quad (2\cdot5)$$

The moments about the mean, factorial moments and cumulants are as given below:

Central moments

$$\mu_2 = 4npq\ (1-3pq);$$

$$\mu_3 = 8npq\ (1-4pq)\ (1-5pq);$$

$$\mu_4 = 16npq + 48n(3n-7)p^2q^2 + 96n(n-4)(n-5)p^3q^3 - 48n(6n^2-27n+70)p^4q^4. \quad .. \quad (2\cdot6)$$

Factorial moments

$$\mu'_{(1)} = 2npq;;$$

$$\mu'_{(2)} = 2npq + 4n(n-3)p^2q^2;$$

$$\mu'_{(3)} = 12n(n-3)p^2q^2 + 8n(n-4)(n-5)p^3q^3;$$

$$\mu'_{(4)} = 12n(n-3)p^2q^2 + 48n(n-4)(n-5)p^3q^3 + 16n(n-5)(n-6)(n-7)p^4q^4. \quad .. \quad (2\cdot7)$$

Cumulants

$$\mathrm{K}_2 = 4npq\ (1-3pq);$$

$$\mathrm{K}_3 = 8npq\ (1-4pq)\ (1-5pq);$$

$$\mathrm{K}_4 = 16npq + 48n\ (2n-7)\ p^2q^2 + 96n(n^2-6n+20)\ p^3q^3 - 48n\ (6n^2-18n+70)\ p^4q^4. \quad .. \quad (2\cdot8)$$

Non-free Sampling :

Krishna Iyer (1950) has proved that the moments about the origin in this case, can be obtained by substitutin $\frac{n_1^{(r)}\ n_2^{(s)}}{n^{(r+s)}}$ for $p^r q^s$ in the corresponding moments for free sampling.* It can be seen that this holds in the present case also.

Hence we get

$$\text{Mean} = \mu'_1 = \frac{2n_1 n_2}{n-1} \qquad .. \quad (2\cdot9)$$

The central moments, factorial moments are as given below :

Central moments

$$\mu_2 = \frac{4}{n-1}\ \frac{n_1^{(2)}\ n_2^{(2)}}{(n-1)^{(2)}}.$$

$$\mu_3 = \frac{16}{n-1}\ \frac{n_1^{(3)}\ n_2^{(3)}}{(n-1)^{(3)}} + \frac{24}{n-1}\cdot\frac{n_1^{(2)}\ n_2^{(2)}}{(n-1)^{(2)}};$$

$$\mu_4 = 16\left(\frac{n_1^{(4)}\ n_2^{(4)}}{(n-1)^{(4)}} - \frac{4n_1 n_2}{n-1}\ \frac{n_1^{(3)}\ n_2^{(3)}}{(n-1)^{(3)}}\right.$$

$$+ \frac{n_1^{(2)}\ n_2^{(2)}}{(n-1)^{(2)}}\left\{1 + \frac{6(n_1-1)\ (n_2-1)}{n-3} + \frac{6n_1^{(2)}\ n_2^{(2)}}{(n-1)^{(2)}}\right\}$$

$$\left. - \frac{n_1^{(2)}\ n_2^{(2)}}{(n-1)^2}\left\{1 + \frac{3n_1\ n_2}{n-1} + \frac{3n_1^2 n_2^2}{(n-1)^2}\right\}\right) \qquad (2\cdot10)$$

* The chance of obtaining r black and s white points in free sampling is $p^r\ q^s$. In non-free sampling, total number of possible ways of selecting $(r+s)$ points from n is $n^{(r+s)}$ of which the favourable number of ways of getting r black and s white points is clearly $n_1^{(r)}\ n_2^{(s)}$ so that the required chance is $\frac{n_1^{(r)}\ n_2^{(s)}}{n^{(r+s)}}$. Hence it is obvious that the moments about the origin for non-free sampling can be obtained from the free sampling moments about the origin by the substitution of $\frac{n_1^{(r)}\ n_2^{(s)}}{n^{(r+s)}}$ for $p^r\ q^s$.

Factorial moments

$$\mu'_{(1)} = \frac{2n_1 n_2}{n-1};$$

$$\mu'_{(2)} = \frac{2n_1 n_2}{n-1} + \frac{4n_1{}^{(2)} n_2{}^{(2)}}{(n-1)^{(2)}};$$

$$\mu'_{(3)} = \frac{12n_1{}^{(2)} n_2{}^{(2)}}{(n-1)^{(2)}} + \frac{8n_1{}^{(3)} n_2{}^{(3)}}{(n-1)^{(3)}}.$$

$$\mu'_{(4)} = \frac{12n_1{}^{(2)} n_2{}^{(2)}}{(n-1)^{(2)}} + \frac{48n_1{}^{(3)} n_2{}^{(3)}}{(n-1)^{(3)}} + \frac{16n_1{}^{(4)} n_2{}^{(4)}}{(n-1)^{(4)}}. \quad .. \quad (2{\cdot}11)$$

It can be easily seen that the number of black — white joins is equal to the total number of black and white runs, which, in Stevens's (1939) notation is equal to "$2p$". Stevens has given

$$\text{Prob}\{p\} = \frac{n_1!\ (n_1-1)!\ n_2!\ (n_2-1)!}{(n-1!\ (n_1-p)!\ (n_2-p)!\ p!\ (p-1)!}$$

The moments given above apply to the distribution of "$2p$" and hence when the necessary changes are made in these for the distribution of "p", they are found to tally with the results given by Stevens for the distribution of "p". The factorial moments given above, when changes are made to get those for distribution of "p", also reduce to the form

$$\mu'_{(k)} = \frac{n_1!\ n_2!\ (n-k)!}{(n_1-k)!\ (n_2-k)!\ n!}$$

which also agrees with the result of Stevens.

3. Distribution of the Total Number of Black — Black Joins

Defining x_i as in section 2, we now consider the function F_2 given by

$$F_2 = \sum_{i=1}^{n} x_i x_{i+1}$$

Evidently F_2 gives the total number of joins of two black points.

The first moment about the origin is $\mu'_1 = E(F_2) = E(\Sigma x_i x_{i-1})$
$= np^2$ .. (3·1)

The second, third and fourth moments about the origin are

$$\mu'_2 = np^2 + 2np^3 + n(n-3)p^4;$$

$$\mu'_3 = np^2 + 6np^3 + 3n(n-1)p^4 + 6n(n-4)p^5 + n(n-4)(n-5)p^6;$$

$$\mu'_4 = np^2 + 14np^3 + (7n+15)np^4 + 12(3n-10)np^5 + 6(n^2-3n-10)np^6 + 12n(n-5)(n-6)p^7 + n(n-5)(n-6)(n-7)p^8 \quad .. \quad (3\cdot2)$$

The moments about the mean and factorial moments are as follows :

Central moments

$$\mu_2 = np^2q\ (1+3p);$$

$$\mu_3 = np^2q\ (1+7p+4p^2-20p^3);$$

$$\mu_4 = np^2q\,[1+15p+3(3n+10)p^2+45(n-2)p^3 + 3(2n^2+9n-50)p^4+3(6n^2-27n+70)p^5] \quad .. \quad (3\cdot3)$$

Factorial moments

$$\mu'_{(1)} = np^2;$$

$$\mu'_{(2)} = 2np^3 + n(n-3)p^4;$$

$$\mu'_{(3)} = 6np^4 + 6n(n-4)p^5 + n(n-4)(n-5)p^6;$$

$$\mu'_{(4)} = 24np^5 + 36n(n-5)p^6 + 12n(n-5)(n-6)p^7 + n(n-5)(n-6)(n-7)p^8 \quad .. \quad (3\cdot4)$$

Non-free Sampling

As indicated for black — white joins, moments about the origin are got by the substitution of $\frac{n_1^{(r)}\, n_2^{(s)}}{n^{(r+s)}}$ for $p^r q^s$ in free-sampling.

$$\text{Mean} = \frac{n_1^{(2)}}{n-1};$$

$$\text{Variance} = \frac{n_1^{(2)}\, n_2^{(2)}}{(n-1).\,(n-1)^{(2)}} \qquad .. \quad (3{\cdot}5)$$

μ_3 and μ_4 are cumbersome.

Factorial moments are are follows:

$$\mu'_{(1)} = \frac{n_1^{(2)}}{(n-1)}.$$

$$\mu'_{(2)} = \frac{(n_1-1)\, n_1^{(3)}}{(n-1)^{(2)}};$$

$$\mu'_{(3)} = \frac{(n_1-1)^{(2)}\, n_1^{(4)}}{(n-1)^{(3)}}.$$

$$\mu'_{(4)} = \frac{(n_1-1)^{(3)}\, n_1^{(5)}}{(n-1)^{(4)}}; \qquad .. \quad (3{\cdot}6)$$

The general form can be inferred to be

$$\mu'_{(k)} = \frac{(n_1-1)^{(k-1)}\, n_1^{(k+1)}}{(n-1)^{(k)}} \qquad .. \quad (3{\cdot}7)$$

The results for white-white joins are got by interchanging p and q for free sampling and n_1 and n_2 for non-free sampling in the results for black-black joins.

4. Distribution of the Total Number of Triplets

Free-sampling

x_i is defined as in the previous two sections. The total number of black triplets in the arrangement of n points on a circle is given by

$$F_3 = \sum_{i=1}^{n} x_i x_{i+1} x_{i+2} = \sum_{i=1}^{n} l'_i \quad \text{(say)}$$

It must be noted that l'_i, l'_{i+1}, l'_{i+2} have the point x_{i+2} common.

Moment about the origin is obtained as $\mu'_1 = \mathrm{E}(\mathrm{F}_3) = np^3$ .. (4·1)

$$\mu'_2 = np^3 + 2np^4 + 2np^5 + n(n-5)p^6 \quad .. \quad (4\cdot2)$$

because $\mathrm{E}(l_i^2) = p^3$, $\mathrm{E}(l_i l_{i-1}) = p^4$, $\mathrm{E}(l_i l_{i+2}) = p^5$ and $\mathrm{E}(l_i l_j) = p^6$. Similarly μ'_3 and μ'_4 are obtained as

$$\mu'_3 = np^3 + 6np^4 + 12np^5 + 3n(n-1)p^6 + 6n(n-5)p^7 + 6n(n-7)p^8 + n(n-7)(n-8)p^9$$

$$\mu'_4 = np^3 + 14np^4 + 50np^5 + (7n+61)np^6 + 36n(n-3)p^7 + 72n(n-6)p^8 + 6n(n^2-3n-36)p^9 + 12n(n^2-14n+45)p^{10} + 12n(n-9)(n-10)p^{11} + n(n-9)(n-10)n-11)p^{12}$$

.. (4·3)

Central moments

$$\mu_2 = np^3q(1+3p+5p^2);$$

$$\mu_3 = np^3q(1+7p+19p^2+16p^3-14p^4-56p^5);$$

$$\mu_4 = np^4q[1+15p+65p^2+9(n+14)p^3+9(5n+2)p^4 + 9(13n-46)p^5+3(2n^2+33n-210)p^6 + 9(2n^2-5n-10)p^7+15(2n^2-15n+66)p^8]$$

.. (4·4)

Non-free sampling

Mean and variance are obtained as below

$$\text{Mean} = \frac{n_1{}^{(3)}}{(n-1)^{(2)}};$$

$$\text{Variance} = \frac{n_1{}^{(3)}}{(n-1)^{(2)}} + \frac{2n_1{}^{(4)}}{(n-1)^{(3)}} + (n_1-3)\frac{n_1{}^{(5)}}{(n-1)^{(4)}} - \left(\frac{n_1{}^{(3)}}{(n-1)^{(2)}}\right)^2 \quad .. \quad (4\cdot5)$$

The third and fourth moments are prohibitively large.

5. Distribution of the total number of Quadruplets

Free sampling

The function that is considered in this case to give the total number of black quadruplets is

$$F_4 = \Sigma\, x_i x_{i+1} x_{i+2} x_{i+3}$$

where x_i is defined as in the previous sections. The results are as follows:

$$\mu'_1 = np^4;$$

$$\mu_2 = np^4q\,(1 + 3p + 5p^2 + 7p^3);$$

$$\mu_3 = np^4q\,(1 + 7p + 19p^2 + 37p^3 + 34p^4 - 2p^5 - 50p^6 - 110p^7); \quad .. \quad (5{\cdot}1)$$

$$\begin{aligned}\mu_4 = np^4q[&1 + 15p + 65p^2 + 175p^3 + 9(n + 34)p^4 \\ &+ 9(5n + 26)p^5 + 3(39n - 70)p^6 + 3(75n - 382)p^7 \\ &+ 3(2n^2 + 69n - 534)p^8 + 3(6n^2 + 9n - 286)p^9 \\ &+ 3(10n^2 - 63n + 182)p^{10} + 21(2n^2 - 21n + 130)p^{11}]\end{aligned}$$

Non-free sampling

$$\text{Mean} = \frac{n_1{}^{(4)}}{(n-1)^{(3)}}$$

$$\text{Variance} = \frac{n_1{}^{(4)}}{(n-1)^{(3)}} + \frac{2n_1{}^{(5)}}{(n-1)^{(4)}} + \frac{2n_1{}^{(6)}}{(n-1)^{(5)}} + \frac{n_1{}^{(7)}}{(n-1)^{(6)}}(n_1 - 5) - \left\{\frac{n_1{}^{(4)}}{(n-1)^{(3)}}\right\}^2 \quad .. \quad (5{\cdot}2)$$

6. Summary

The distributions of joins of (a) points of the opposite colours (b) of the same colours (c) triplets and (d) quadruplets have been studied.

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CHARACTERISTICS OF ADOLESCENT GIRLS FANTASY

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ABSTRACT

Thirty adolescent girls with mean age of 13 years and 8 months belonging to the middle and lower middle class families, were studied with five pictures of TAT and fifteen armatures of VPT in order to find out the characteristics of adolescent girls fantasy.

The study revealed that girls' frequently entertained the following fantasy: depression, anxiety, jealousy, success and ambition, family relations, love, economic concern, and entertainment.

The prevalence of symptomatic themes of depression, anxiety, and jealousy, were all attributed to lack of proper facilitation at home and at school for the fulfilment of important needs like sensorigratification, recognition, belongingness, affection and achievement. The presence of themes of success and ambition, love and entertainment are all considered as signs of normal emotional development and growth.

Proper facilitation for the fulfilment of the above mentioned needs it is suggested will reduce the increasing number of delinquents and neurotics, and the scheme of education and reform at home and at school should pay attention to this important issue.

INTRODUCTION

Ordinarily fantasy is considered as unreal part of the mind and therefore unimportant. But studies of fantasy by H. A. Murray (1938), J. H. Masserman and E. R. Balken (1939), P. M. Symonds (1946 and 1949) to mention only a few, reveal that though fantasy is intangible and fleeting, it still has an actual existence and is very influential in shaping personality and character.

There are different methods for securing fantasy. In the early years of scientific development of Psychology, fantasy was obtained through dreams. S. Freud (1932) was the first to attempt in this direction. Recent developments in the study of

fantasy are through the 'Projective Techniques' (1939). The projective techniques are all brought under two broad groups and they are known as *expressive* and *interpretive* techniques. The expressive techniques consist of making subjects shape as they like certain unstructured substances. Modelling clay, soap and drawing pictures are all examples. Interpretive techniques employ materials which are structured in a vague way, and the subject, are asked to interpret. The Rorschach Method and the Thematic Apperception Method are important examples.

Purpose of the Present Study: It is an established fact that adolescence is an important period in the development of the human individual. The proper understanding of adolescence and the dynamisms operating in their adjustment, therefore will be of immense help, for any scheme of education or reform. Understanding of the nature of fantasy of the adolescent will be useful in this direction. The present investigation, therefore, was directed towards understanding the characteristics of adolescent fantasy. In an earlier investigation an aspect of adolescent boys fantasy was studied by the author (1950). Here a study of the fantasy of the adolescent girls alone was attempted.

Subjects of the Study: Thirty girls with mean age of 13 years and 8 months, studying in IVth and Vth Forms in a High School in the city of Madras were made use of in the study. The girls belong to the middle and lower middle class families. Their I.Q. estimated on the basis of their performances in the school examination, ranged from average to superior.

Methods of Study: Two tests were made use of in this study. They are the Thematic Apperception Test and Verbal Projection Test. These two tests belong to interpretive technique group. From the Thematic Apperception Test only five pictures were made use of and from the Verbal Projection Test fifteen armatures were made use of. The TAT[1] pictures are from the Harvard University Press set and the 'armatures' of VPT are from the author's original test, used for boys. They are modified to suit the girls. The five TAT pictures are as follows:—

1. Picture 1—A boy with a violin.
2. Picture 2—A man with a horse and two women characters.

1. Usually, the Thematic Apperception Test is referred to as TAT, and Verbal Projection Test as VPT.

3. Picture 4 — A man and a woman.
4. Picture 3 GF — A girl leaning on a door with one hand covering her face.
5. Picture 9 GF — One girl walking alone and another girl behind a tree.

The armatures from the VPT are as follows:—

1. While other girls are playing one girl is standing in a corner.
2. A girl is walking in a narrow street looking behind often.
3. Two figures standing naked are seen in the darkness.
4. A girl is walking along with books in her hands; groups of other girls were found.
5. Brother and sister are together; a grey-haired man is standing near a widow, with his back towards them.
6. The class is going on; a girl is found thinking something.
7. It is midnight; a barking sound of a dog is heard in the distance.
8. A girl is standing in a crowded place and is staring at the people.
9. Mother embracing her child, kisses it; father is present; a girl is looking at them.
10. A girl is hesitatingly standing outside a temple.
11. A girl is rolling on her bed without sleep.
12. A girl standing on the bank of a river, is looking at the still waters.
14. A corpse is being taken; a girl is looking at it.
15. A girl and a lamp are seen in the dark.

These two tests were supplemented by interview. Interview afforded scope for collecting information regarding family background, clarification of details in the stories given by the subjects etc.

Administration and Collection of Data

The TAT was administered individually but simultaneously to five girls at a time, each taking a picture. The time given was four minutes. The VPT was administered to a group of ten at a time, time given for each armature was four minutes. The technique of administration and instructions for TAT are the same as those used by Murray, H.A., (1943) and for VPT the one used in an earlier study by the author (1950). The instructions were all done in Tamil and the subjects were to record their stories. The total number of stories collected were 600.

RESULTS

	Themes	Total	Per Cent	Av. Per Cent
1.	*Family relationships* ..	370	61·3	5·6
	Mother ..	83	13·8	
	Father ..	79	13·1	
	Family ..	6	1·0	
	Parents ..	59	9·8	
	Son ..	4	0·7	
	Husband ..	24	4·0	
	Children ..	30	4·7	
	Home ..	9	1·6	
	Wife ..	5	0·8	
	Sister ..	17	2·8	
	Daughter ..	10	1·7	
	Brother ..	20	3·3	
	Step Mother ..	24	4·0	
2.	*Aggression* ..	258	43·0	3·3
	Death ..	85	14·2	
	Crime ..	2	0·3	
	Criminal murder ..	7	1·2	
	Scolding ; nagging ; disapproval	8	1·3	
	Violent death ..	5	0·8	
	Fighting ; arguments ..	15	2·5	
	Anger ; rage, wrath ..	27	4·5	
	Stealing, robbing ..	50	8·3	
	Bullying ..	13	2·2	
	Ridicule ; contempt ..	4	0·7	
	Resentment ..	15	2·5	
	Toughness ..	9	1·5	
	Suicide ..	18	3·0	
3.	*Economic Concern* ..	101	16·8	4·2
	Money ..	11	1·8	
	Job, work ..	6	1·0	
	Wealthy, rich ..	24	4·0	
	Poor ..	60	10·0	
4.	*Punishment* ..	58	9·6	2·4
	Police ..	11	1·8	
	Punishment ..	23	3·8	
	Capture, apprehension ..	21	3·5	
	Prison, jail ..	3	0·5	
5.	*Love and Sex* ..	135	22·4	3·7
	Marriage, being married ..	49	8·2	
	Boy-girl situations ..	12	2·0	
	Friends ..	47	7·8	
	Love, falling in love ..	14	2·3	
	Eroticism ..	11	1·8	
	Homo-sexuality ..	2	0·3	

	Themes	Score	Per Cent	Av. Per Cent
6.	*Sociability* ..	8	1·3	0·5
	Parties ; dances ..	6	1·0	
	Gangs ..	2	0·3	
7.	*Morality ; goodness* ..	11	1·8	0·9
	Goodness ; rightness ..	9	1·5	
	Conformity ..	2	0·3	
8.	*Badness ; wrong* ..	15	2·5	1·3
	Bad Companions ..	2	0·3	
	Wrong ..	13	2·2	
9.	*Appearance* ..	47	7·8	7·8
10.	*Guilt ; conscience* ..	20	3·3	3·3
11.	*Yearning ; wanting* ..	16	2·7	2·7
12.	*Jealousy ; envy* ..	33	5·5	5·5
13.	*Entertainment* ..	29	4·8	4·8
14.	*Religion* ..	28	4·6	1·2
	God angel, Rishi, etc. ..	22	3·7	
	Prayer etc. ..	2	0·3	
	Heaven ..	4	0·6	
	Dreams ..	2	0·3	
15.	*Depression ; sadness* ..	147	24·5	12·2
	Discouragement ..	38	5·8	
	Trouble ..	109	18·7	
16.	*Separation ; dejection* ..	44	7·3	1·5
	Distant places, trips ..	—	—	
	Run away ..	7	1·2	
	Loneliness ..	17	2·8	
	Rejection ..	18	3·0	
	Desertion ..	2	0·3	
17.	*Altruism* ..	20	3·4	1·7
	Love and service to parents ..	13	2·2	
	Hero ..	7	1·2	
18.	*Anxiety* ..	84	14·0	7·0
	Anxiety, worry ..	17	2·8	
	Fear, dread ; alarm ..	67	11·2	
19.	*Success* and *ambition* ..	59	9·5	4·8
	Success ..	49	7·8	
	Ambition ..	10	1·7	
20.	*Repentance ; reform* ..	16	2·6	1·3
	Reform ..	11	1·8	
	Lesson learned ..	5	0·8	
21.	*Accident* and *illness* ..	38	6·2	3·1
	Accident ..	14	2·3	
	Illness ; sickness ..	12	2·0	
	Doctors ; nurses ; hospitals ..	4	0·6	
	Injury, wounds ..	8	1·3	
22.	*Thinking ; decision* ..	20	3·2	1·6
	Wondering ; thinking ; musing	17	2·8	
	Deciding ..	3	0·4	

Themes	Score	Per Cent	Av. Per Cent
23. *School* ..	37	6·1	3·1
Teacher ..	31	5·1	
Books ..	6	1·0	
24. *Positive emotion* ..	36	6·0	3·0
Happiness ..	26	4·3	
Fun, good times ..	10	1·7	

Analysis of the Stories: In the analysis of the stories, each story was split into different themes and in analysing the themes and scoring them, P. M. Symonds's (1949) method was wholly adopted. Symonds brings various themes under three broad categories; they are Psychological, Environmental and Stylistic. Here Psychological and Environmental themes alone are considered. The scheme consists of 24 main divisions and each division in some cases with sub-divisions. The scheme is presented along with the results to save space. The original idea to study the age differences in the nature of fantasy was abandoned because of the smallness of the sample, and only the result of the total group is presented below.

RANK ORDER OF MAIN THEMES

1.	Depression ..	12·2
2.	Appearance ..	7·8
3.	Anxiety ..	7·0
4.	Family Relationship ..	5·6
5.	Jealousy and Envy ..	5·5
6.	Entertainment ..	4·8
7.	Success and ambition ..	4·8
8.	Economic Concern ..	4·2
9.	Love and Sex ..	3·7
10.	Aggression ..	3·3
11.	Guilt and Conscience ..	3·3
12.	School ..	3·1
13.	Accident and illness ..	3·1
14.	Positive Emotion ..	3·0
15.	Yearning and wanting ..	2·7
16.	Punishment ..	2·4
17.	Altruism ..	1·7
18.	Thinking ..	1·6
19.	Separation ..	1·6
20.	Badness; wrong ..	1·3
21.	Repentence and Reform ..	1·3
22.	Religion ..	1·2
23.	Morality and goodness ..	0·9
24.	Sociability ..	0·6
	Average percent ..	3·6

Items above 3·6% were alone considered significant and they are as follows :

Depression ; Appearance ; Anxiety ; Family Relations ; Jealousy ; Entertainment ; Success and Ambition ; Economic concern ; and Love and Sex.

Discussion of the Results and Conclusion

1. Themes of *depression* are highest in the order. Most of the themes of depression centre around difficulties at home ; mother being against higher studies ; step-mother's ill-treatment ; being poor without jewels and good dress. Discouragement at school is also frequent and also depression over the loss of father or mother or in some cases both.

2. Themes relating to *appearance* are found mostly in younger girls, unusually to our expectations. This concerns with complexion, dress and jewels.

3. Themes of *anxiety ;* Themes of anxiety ranged from acute anguish to mild states of vague apprehension or being ill at ease. Most anxiety themes result when there is anticipated punishment or danger from step-mother, mother and teacher. Anxiety due to sense of guilt owing to aggressive and hostile feelings towards mother and father and friends are present.

4. Themes referring to *family* and in the family they centre around mostly on mother, father and in older girls, on husband and step-mother. Usually the relationship with father is one of respect and towards mother one of intense ambivalence. Mothers are usually portrayed as trying to cut down the freedom of the individual by so many 'don'ts.' The reaction is one of strong aggression directed towards self-punishment. Husband is portrayed often as ill-treating or having connection with other girls or as losing job and being depressed. Happy relationship is rarely portrayed.

5. Themes of *Jealousy and envy* centre around other girls being well of, and having good dress and costly jewels and also around class-mates, who study well and get the recognition of others. Jealousy and envy usually lead to hostile acts, mostly in attempts to degrade other persons to destroy their fame.

6. *Entertainment* themes centre around sports and games. Movies, drama etc., are not present to such an extent as was expected. May be they have not still become part of girls' lives

and quite a number of girls who mentioned about them did not exhibit intense desire about them.

7. Themes of *Success and ambition* are mostly in the form of being of humble origin, studying well, in spite of obstacles and getting the first place and winning admiration of the head-teacher. Being born poor, succeeding in getting a rich husband and becoming rich are also common themes.

8. Themes relating to *economic concern* are also common. Mostly they relate to being poor ; parents being poor ; not being able to wear jewels and not able to go for higher studies. Not being able to marry because of poverty are also present.

9. *Love* themes are of next importance. There are very small number of erotic themes. Under love, marriage and being married are prominent. Love themes are often of Cindrella type; poor beautiful girl drawn towards rich hero or sometimes being saved from serious accident by a hero and getting married to him. Love towards brothers, but not so often towards parents, are present.

Conclusion

It could be observed that most of the themes centre around mother, father, home, husband, step-mother and poverty. Themes denoting depression, anxiety etc., which are foremost in the rank order are found to be due to lack of proper adjustment at home. It may be that the basic needs of the individuals which were finding proper facilitation and fulfilment during the childhood, come out with resurged force, owing to the growth and development which are natural and inevitable during the period of adolescence; and particularly so in the early period of adolescence, which happens to be in the subjects studied here. The sensori-gratification need start functioning with increased vigour owing to glandular and physical changes and the needs of recognition, belongingness, and affection, owing to emotional development. The home the school and the society at large treat these adolescents, still as children. They remain socially as children but physically with all the equipments of an adult and therefore the needs remain not properly facilitated and they quite often remain frustrated. The frustrated needs take a deviated form and manifest themselves in emotional imbalance with symptom of depression. anxiety, aggression etc. The adolescents feel insecure, a sort of dust in the air. This may probably account for the ever increas-

ing number of delinquents, criminals and neurotics during the period of adolescence. Therefore any scheme of reform and education would do well to consider the problem of proper facilitation of the increased demands of the basic needs. This will go a long way in reducing the number of delinquents and neurotics, though total eradication of them will be an utopian idea.

There are also themes referring to proper emotional development of the girls studied. They are themes of success, ambition and love, and appearance.

Appendix

Examples of Fantasy and the themes present in them.

TAT Picture 9 GF :

1. A rich girl walking along the beach, nicely dressed. Everybody is looking at her. She is a showy girl. Rowdy boys whistled at her and laughed at her ; a poor girl, hiding behind a tree, was looking at her dress. The rich girl came to her and asked why she is laughing at her. The poor girl pointed towards the boys. Showy girl looked at them and started feeling shy.

2. Two girls dressed up beautifully are playing hide and seek in the beach. By playing like this they become strong and healthy. Now one is trying to find out where the other one is hiding. She found her out. They are very happy. They had sweet-meats and they enjoyed eating them.

3. A rich girl went along with her parents to the beach. She had lot of jewels, and costly silk dress on her. While playing she lost her way and went to a different place. Another girl looking at her carries her to a different place and removes all her jewels and dress. Parents search for her and do not find her.

4. She is a very rich girl. One day when she was taking a walk in the beach, a girl hid herself, looks at her ; thinks who could be the individual. She decides to steal her jewels. But the police suspecting her arrest her and take her.

VPT Armature 1 :

1. Other girls considered her as bad girl and removed her. She is feeling sad for this. Thinks why she is bad and feels for it.

2. Sushila lost her diamond jewel ; she is afraid that her parents will beat her. She is imagining how father and mother will react to it. She is praying god to help her.

3. The girl was talking in the class and teacher punished her. During the games period, she did not play but feels sad for hav-

ing talked in the class. Waiting for the teacher to apologise to her.

4. The girl is poor and also limp. One day, she ran hurriedly along the road, not seeing a car coming on two sides ; she slipped and fell beneath a car. Luckily she escaped with small injuries.

Themes in TAT 9 GF example stories :

1. Riches ; Appearance ; Aggression.
2. Appearance ; Happiness ; Entertainment.
3. Riches ; Appearance ; Trouble ; Parents.
4. Richness ; Stealing (aggression) ; Police ; Apprehension.

Themes in VPT armature 1, example stories :

1. Badness ; Discouragement ; Guilt ; Repentance.
2. Trouble ; Discouragement ; Parents ; Father ; Mother ; God ; Anxiety.
3. Teacher Punishing ; Discouragement ; Guilt and Conscience ; Repentance.
4. Poverty ; Injury ; Accident.

Each theme is given a score of one and if a theme is found more than once in the same story, it is also scored. These different themes present in different stories are scored under sub-divisions under the main divisions ; e.g., stealing is sub-division under aggression. The sum of the scores in the sub-divisions will be the score of the main division. This paper focusses its attention, mainly on the main divisions, though references to sub-divisions are also made in the discussions.

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A SHORT REVIEW OF THE CHEMISTRY OF COUMARAN-3-ONES

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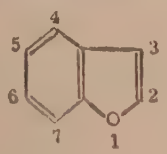
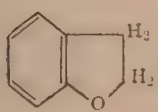
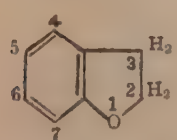
1. Introduction

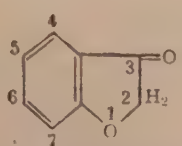
Ortho-condensation of a benzene ring with furan in the 2-3 and 3-4 position gives products known as benzofurans (coumarones) or iso-benzofurans (iso-coumarones) respectively. The numbering system for benzofuran is



2, 3 dihydrobenzofuran,  is also called coumaran and coumaranone (coumaran-3-one) is 3-keto, 2, 3-dihydrobenzofuran.



2, 3-dihydrobenzofuran

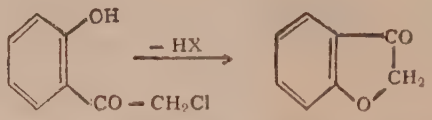


3-keto — 2, 3-dihydrobenzofuran, coumaranone, or coumaran-3-one

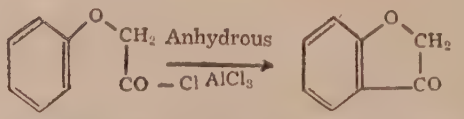
2. Methods of Preparation

Coumaran-3-one is the parent compound of the coumaranone series. These compounds can be prepared by one or more of the following methods:

(1) By cyclization of 2-hydroxy — w-chloro acetophenone with dilute alkali (Friedländer and Neudorfer, 1897 and v. Auwers 1912, 1914).

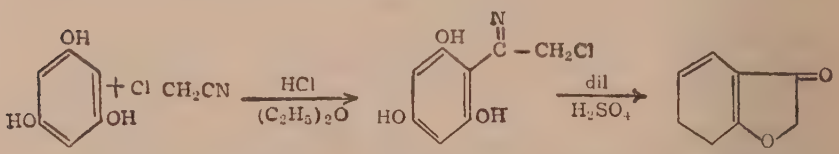


(2) By cyclization of the acid chloride of phenoxy acetic acids with $AlCl_3$ (Stoermer and Attenstädt, 1902).

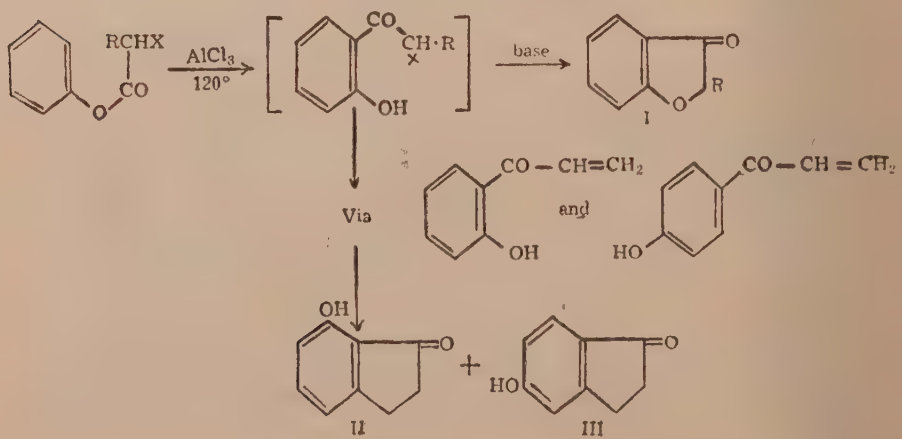


(3) By cyclodehydration resulting in ring closure of phenoxy acetic acids with P_2O_5 (Stoermer and Bartsch, 1900).

(4) By Houben-Hoesch reaction of chloraectonctrile on appropriate phenols (Sonn, 1917).

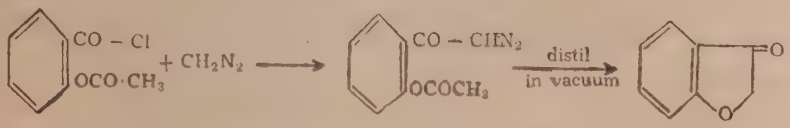


(5) By an analogous reaction by a preliminary Fries rearrangement of a phenylester of an 2-halogen-acid (v. Auwers 1919, 1911, and — & Hilliger, 1916).



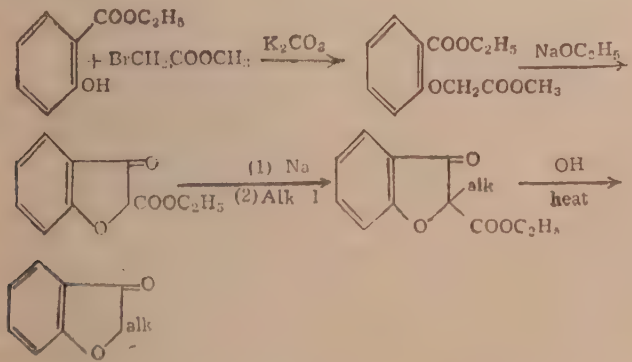
The disadvantage of this method is that hydrindones of the type II and III are sometimes formed as predominating products.

Another reaction in which the actual ring closure follows this same general pattern involves insertion of the 2-carbon atom by means of diazomethane.

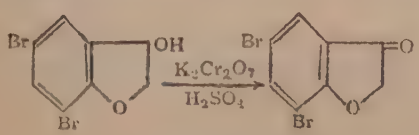


(6) From 3-keto — 2-carbyloxy coumarans:

3-keto — 2-carbyloxy coumarans which react as β-keto-esters can be decarboxylated to give coumaranones. (Friedländer 1899, v. Auwers 1912). Thus salicylic ester is condensed with bromaectic ester and ring closed. Carbon alkylation is then carried out, and ketonic hydrolysis of the resulting compound gives 2-alkyl-coumaran-3-ones:



(7) Oxidation of 3-hydroxy coumaran derivatives results in the formation of coumaranones: (Fries & Moskopp, 1910).



3. Properties

Most of the coumaranones are crystalline solids. Coumaranone itself is a white crystalline solid. In contrast to the β-hydroxy derivatives of furan, it is a fairly stable substance and the stability

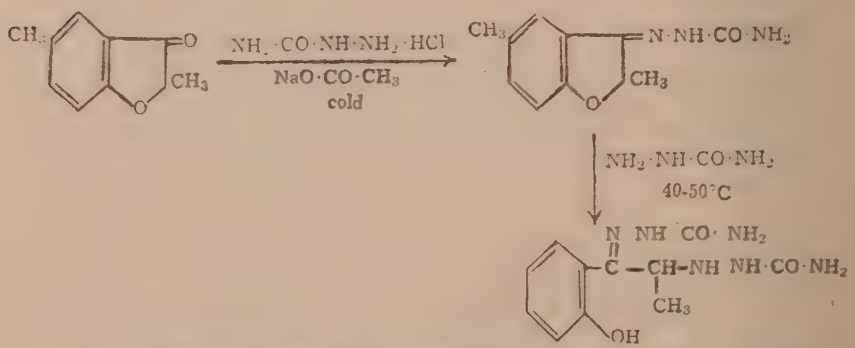
can be attributed to the added resonance stabilization of the benzene ring. It reduces Fehling's solution and Tollen's reagent rapidly. Its behaviour when titrated with bromine points its existence exclusively in the keto form.

4. Reactions

Coumaran-3-one has chemical properties both of a ketone and of an enol in accordance with its tautomeric nature :

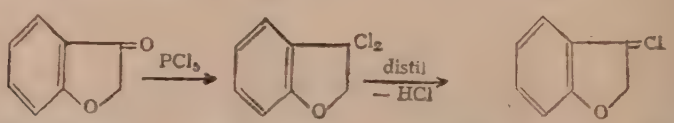
(A) Reactions as a Ketone

(1) Coumaranones and the 2-alkyl derivatives readily give oximes. The normal carbonyl derivatives with phenyl hydrazine and semi-carbazide are obtained with difficulty, because the molecule is susceptible to basic reagents. However 2-4-dinitro phenyl hydrazine in many cases forms the 2, 4-dinitrophenyl hydrozone, which are often crystalline compounds which sharp melting point. With semi-carbazide the reaction is as follows :

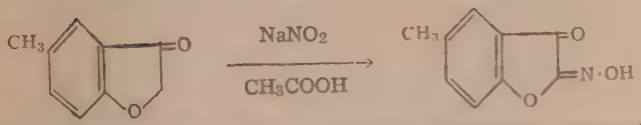


Further oxidation to bis-semi-carbazone does not take place.

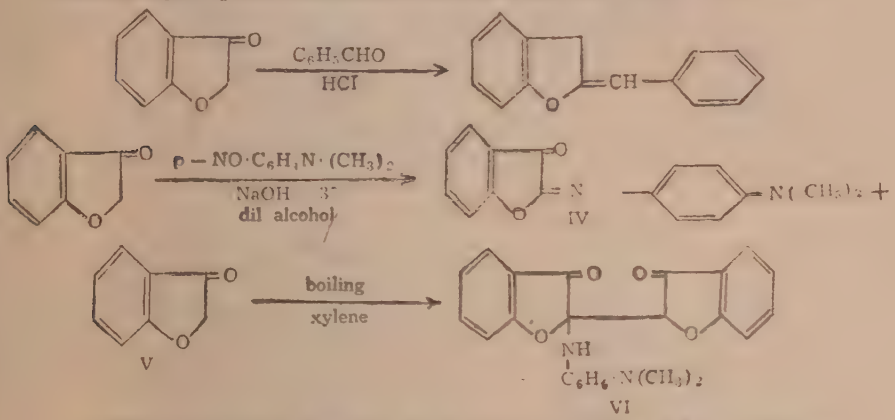
(2) With PCl_5 the ketonic oxygen is replaced by two chlorine atoms and the resulting dichloride on dehydrochlorination yields 3-chloro-benzo-furan.



(3) Coumaran-3-ones with no substituent in the 2-position yield 2-isonitroso derivatives on treatment with nitrous acid.

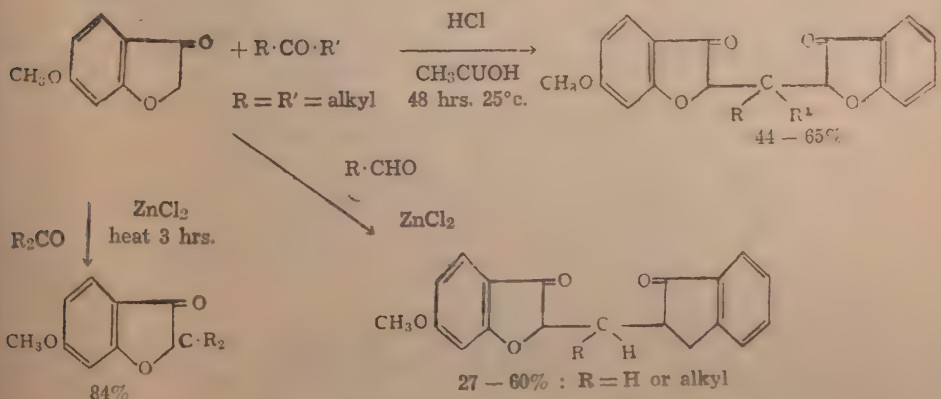


(4) Coumaranones carry a reactive methylene group in the 2-position and hence readily give condensation products with benzaldehyde, p-nitrosodimethyl aniline and such other compounds.



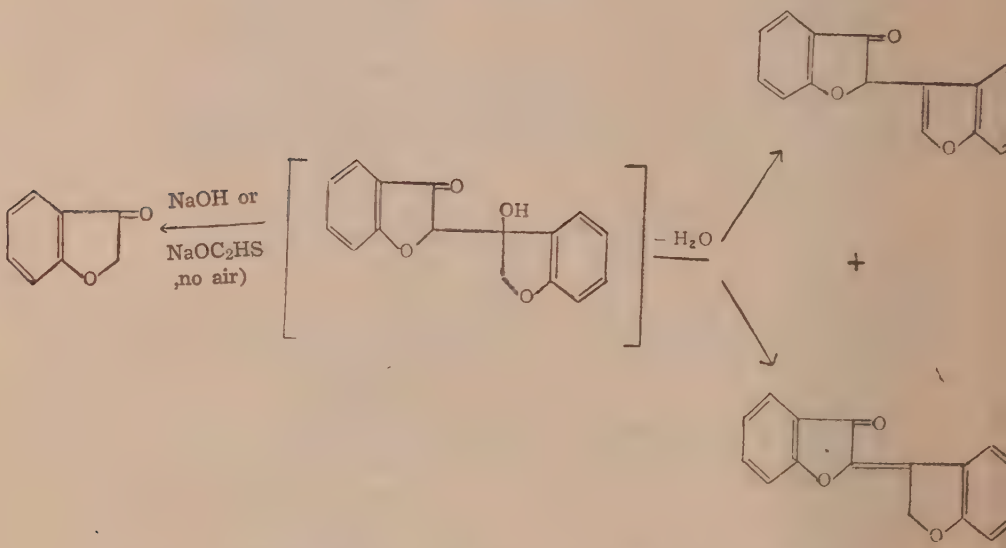
When the latter reaction takes place in boiling xylene, addition of another molecule of V to the azomethine linkage of IV takes place with the formation of VI.

When 6-methoxy-coumaranone is condensed with aldehydes and ketones, condensation takes place at the reactive methylene group and when the reaction is carried further, a second molecule of coumaranone enters into it. (Shriner & Anderson 1938, & Witte 1941).

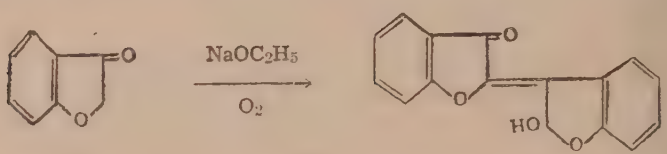


(5) By aldol condensation with itself and subsequent oxidation, coumaran-3-one gives a series of oxygen analogues of indirubin,

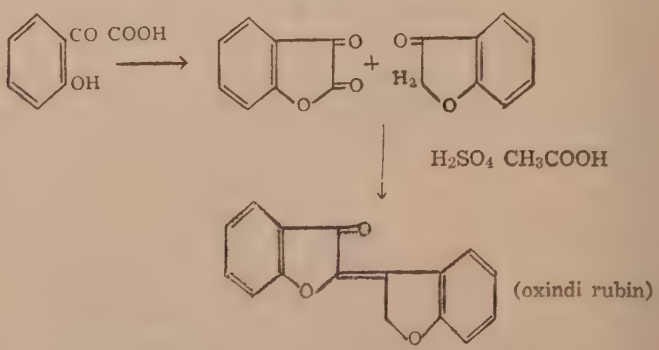
but when condensed in the absence of air, two double bond isomers are formed :



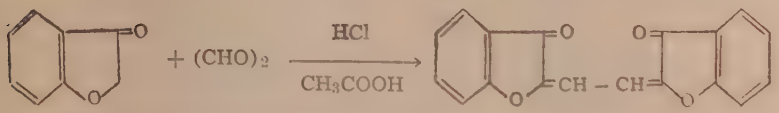
In the absence of air, the leuco-compound of oxindirubin is formed :



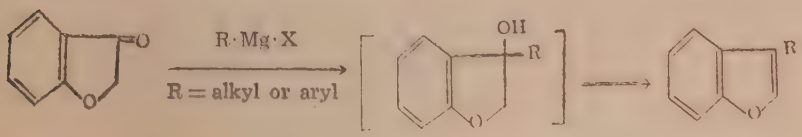
Oxindigo itself is formed when coumaranone is condensed with O-hydroxy-phenyl glycollic acid, which probably proceeds through coumaran-2, 3-dione. (Fries & Pfaffandorf, 1910).



(6) Coumaranone reacts with glyoxal. (Friedländer & Risse, 1914).



(7) Coumaranone reacts with Grignard reagents like a typical ketone. The carbinol first formed undergoes dehydration during decomposition of the magnesium complex to yield a 3-substsituted benzofuran :



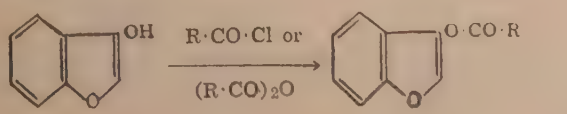
(B) Reactions of Coumaranone as an Enol

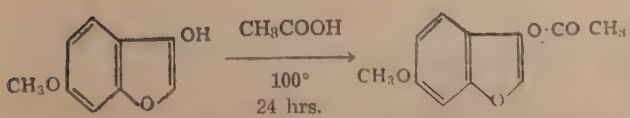
Though chemical evidence favours the existence of coumaranone predominantly in the ketonic form, a few reactions can be better explained on the enolic (3-hydroxy benzofuran) structure.

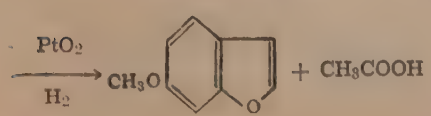
(1) Coumaranone is soluble in cold alkali solution and can be reprecipitated by acid.

With warm alkalies the ring is opened with the formation of salicylaldehyde.

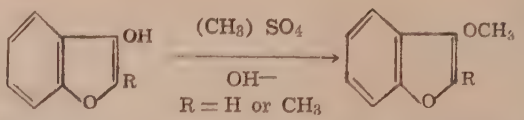
(2) Acylation with acid chlorides and acid anhydrides gives enol esters. Acetic acid itself gives 3-acetoxy-benzofuran derivatives, which, on catalytic reduction, undergo hydrogenolysis to yield benzofuran :



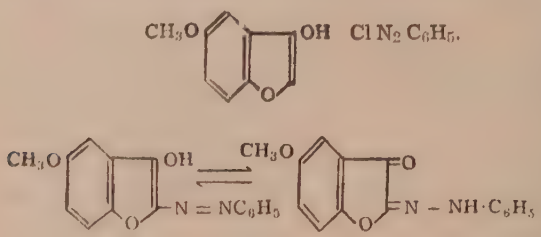




(3) Methylation with dimethyl sulphate gives 3-methyl-benzofuran derivatives :



(4) Coumaranone undergoes coupling reactions with diazonium salts, thus indicating their behaviour like phenols :

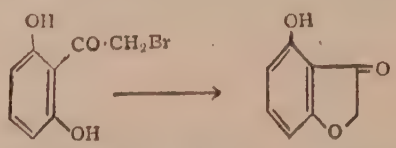


5. Derivatives of Coumaran-3-ones

(A) The Oxy-Derivatives

All the mono-hydroxy or methoxy derivatives of coumaranone have been prepared.

4-Hydroxy coumaranone has been obtained by ring closing the corresponding w. bromo-acetophenone (Shriner & Witte, 1939).



5-Methoxy coumaranone has been prepared by Shriner & Damschroder (1938).

6-Hydroxy-coumaranone has been prepared by the condensation of resorcinol with chloracetonitrile (Horning & Reisner 1948, and Takei and Miyajima, 1929).

Hoesch reaction of $(CH_3)_2CH-CH\cdot Cl\text{-}CN$ with resorcinol yields 2-isopropyl — 6-hydroxy-coumaranone (Yamoshita, 1935). The same compound and 6-hydroxy — 2-propyl coumaranone have also been obtained by Bua Kamthong and Alexander Robertson, 1939.

7-Hydroxy coumaranone is prepared by the action of boiling water on w-bromo-2, 3 diacetoxy acetophenone in the presence of excess of chalk. (Mosimann & Tambor, 1916).

These oxy-coumaranones undergo condensation with aliphatic aldehydes, and ketones, the condensation taking place at 2-position. Formaldehyde, acetone and cyclohexanone condense with 6-methoxy-coumaranone in presence of zinc chloride giving 2, 2′ bis (6-methoxy-coumaranone) methane, m. 169-70°, 2-iso-propyl derivative, m. 141·0—2·0°, and 2-cyclo-hexylidene derivative, m. 146·5—7·5° respectively (Shriner & Anderson, 1938).

The condensation of coumaranones with some aromatic aldehydes has also been reported (Kumar, Rao & Ray, 1946).

Many of the possible di-oxy compounds of coumaranones are prepared.

4, 6-dihydroxy—(Sonn, 1917), 4, 6-dimethoxy—, and 4, 6-diacetoxy-compounds are all known. 4, 7-diacetoxy coumaranone is also prepared by Sonn (loc. cit). The 5, 6-di methoxy—, (Jones, Mackenzie, Robertson & Whalley, 1949), 5, 7-dioxy — and 6, 7-dioxy derivatives have also been prepared.

4, 5 — and 6, 7-dioxy coumaranones do not seem to have been prepared.

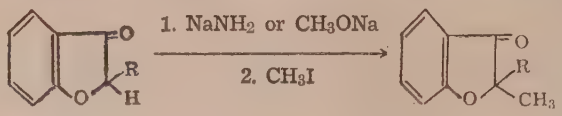
Of the tri-oxy derivatives, while the 4, 5, 7 — and 5, 6, 7-trioxy derivatives do not seem to appear in the literature, the 4, 5, 6 trimethoxy —, 4, 6 dihydroxy — 5 (and 7) methoxy —, 4, 6, 7 trimethoxy —, 4, 6, 7, trimethoxy —, 4, 7, dimethoxy —, 6 oxy-derivatives have all been worked up. (Shriner, Maston and Damschroder, 1939); 4, 6-dihydroxy — 5 (and 7) acetyl-coumaranone have been prepared by the action of chloracetonitrile on $(HO)_3C_6H_2Ac$ in presence of aluminium chloride (Gruber & Traub, 1947).

(B) Alkyl Coumaranones

2-alkyl coumaranones have been prepared in general by the method adopted by Friedländer (1899) and Auwers (1912) or by Auwers, Bahr, Wegener and Wiegand's (1928) method.

2-Methyl coumaranone is characterised by its optical constants (Auwers, 1919) and also by its semi-carbazide. The hydrogen in

the 2-position of a 2-alkyl-coumaranone can be replaced by alkyls, when the substance is treated with strong base and alkyl iodide.



5-methyl coumaranone is prepared from p-cresoxy acetic acid or w-chloro acetophenone (6-OH —, 3-Me —), while other methods are also available.

6-methyl-coumaranone is obtained in small yield by the action of P_2O_5 on *m*-cresoxy-acetic acid. It can be prepared from w-chloro — 2-oxy — 4-methyl-acetophenone in alcoholic solution by boiling with crystalline sodium acetate.

7-methyl-coumaranone is formed by the action of P_2O_5 on *O*-cresoxy-acetic acid.

Among the dialkyl derivatives, 4, 6-dimethyl-coumaranone is formed by heating 2, 3-di-methyl — phenyl acetic ester with aluminium chloride, while the 4, 5 and 4, 7-derivatives are probably not known.

In the preparation of tri-alkyl derivatives, a modification in the method for 2, 3, 5- tri-methyl — C_6H_2O — CH_2COOH gives an 86% yield of 4, 6, 7-tri-methyl — 3-coumaranone when heated with H_2SO_4 at 90°C for 10 minutes. Frequently the product is a compound of unknown structure (Smith & Boyack, 1948). Of the other tri-methyl derivatives, 2, 2, 7 —, 2, 3, 5-tri-methyl 2-naphthylamino and 2-thiocyano, 2, 2, 3 —, 2, 2, 4 —, 2, 2, 5 — and 2, 3, 5-tri-methyl derivatives are quoted in the literature. 2, 2, 4, 6-Tetra-methyl coumaranone is obtained in small amounts by treating the bromo-derivative of *o*-iso-butyro — *as*-*m*-xylenol with concentrated caustic potash. Its m.p is 68-9° and b.p 118°-20° at 13 m.m. (Auwers, Baum & Lorenz, 1927).

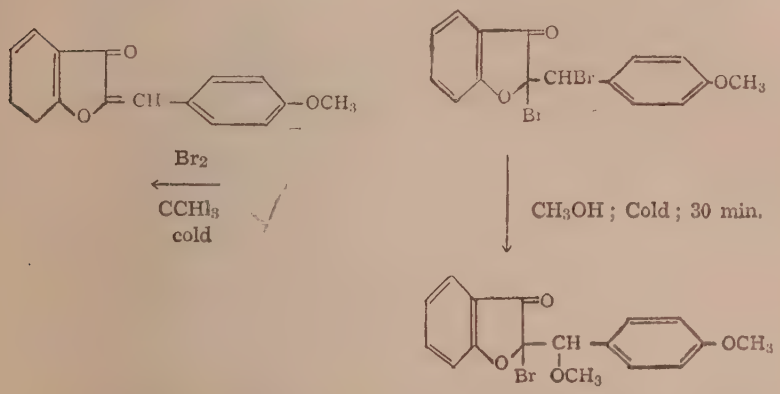
In addition to the methyl coumaranones several other derivatives with one or more C_2H_5 —, Pr —, Bu —, and other alkyl groups along with other substituents like McO, HO, AcO, etc., are also known.

(C) Benzal Coumaranones

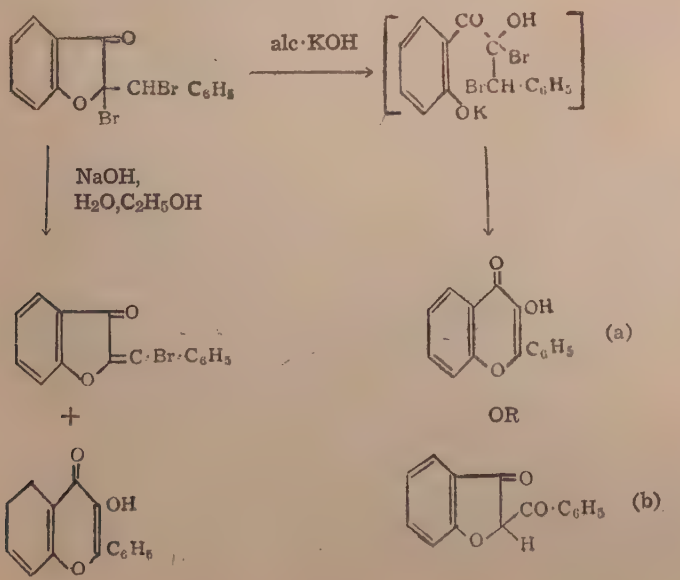
Because of the presence of the reactive methylene group, condensation of aromatic aldehydes take place in 2-position of the

coumaranones, resulting in the formation of 2-benzal—(benzylidene)—coumaranones.

The 2-benzylidene coumaran-3-ones parallel the chalcones of the benzene series in their reactions (Panse, Shah & Wheeler, 1941). With bromine in chloroform, addition of bromine takes place across the C-C-double bond:



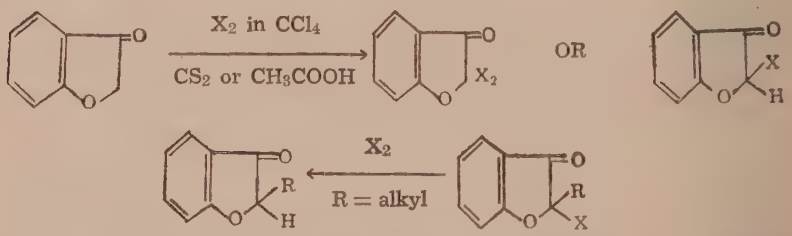
The dibromides on treatment with bases, undergo either dehydrobromination or ring enlargement to flavonols:



The formation of the flavonols (a) or 2-benzoyl-coumaran-3-ones (b) depends on the ease with which the coumaranone ring opens. Methyl,methoxy, and chlorine in the *ortho* and *para* positions to the ring oxygen atom of the coumaranone aid the formation of flavonol (Auwers, 1916 and Minton & Stephen, 1922), while methyl and methoxy group, in the *meta* position hinder it. Dichlorides instead of dibromides in the latter reaction form flavonols in poor yields. Auwers and Pohl in their synthesis of fisetin and its dimethyl ether (Auwers & Pohl, 1915) obtained only a 6% yield from tri-methyl—benzal—coumaranone—di-chloride. Since most of the flavonol derivatives are derived from phloroglucinol, the *meta* position to the coumaranone oxygen is substituted and as such v. Auwer's method is difficult. Probably the presence of a HO-gr in the o—and p—positions overcomes the hindering influence. If both positions are substituted, both types of compounds are formed.

(D) Halogen Derivatives of Coumaranones

Halogenation of coumaranone results in the 2-substituted mono—or di-halogen derivatives, the reactive methylene group being attacked.

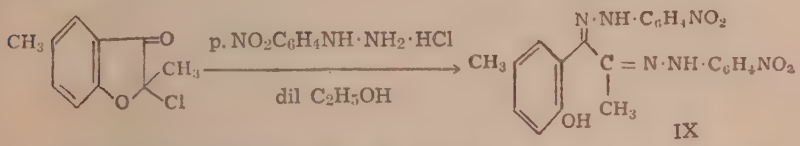


The halogens are extremely reactive, because the substances are both α-halo ketones and α-halo ethers. They readily undergo displacement reactions by such ions as the hydroxyl, acetate or alkoxyl, when treated with sodium carbonate in dilute acetone, $AgO\text{-}CO\text{-}CH_3$ or $KO\text{-}CO\text{-}CH_3$ in acetic acid or $NaOCH_3$. It is interesting to note that substances of the type VII in which R = methyl, do not undergo dehydration, and as the product of reaction

VII VIII

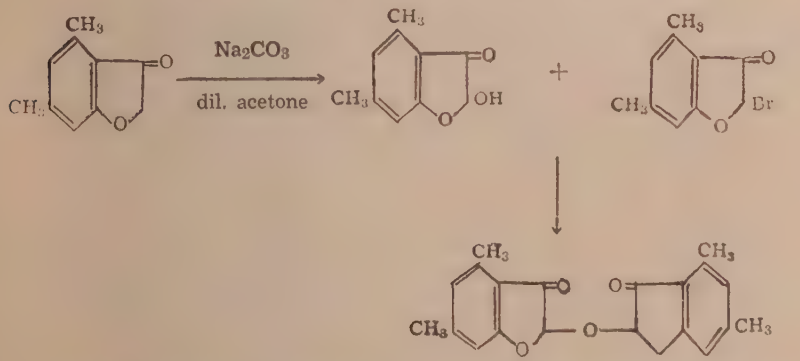
is soluble in alkali, it has been suggested that ring opening may have occurred to yield the product VIII (Auwers & Muller, 1917).

In one instance, the expected elimination reaction may have taken place with the formation of IX, (Auwers & Schütte, 1919). However hydrolytic removal of chlorine to yield the 5-methyl derivative of VII as an intermediate may also account for the formation of IX.

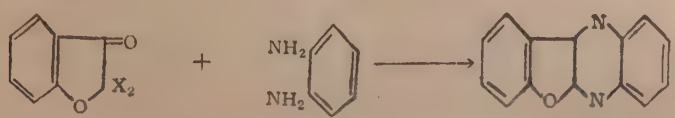


IX

2-Bromo-coumaran-3-ones give rise to 2, 2′ (3, 3′ dihydroxy-benzofuryl) ethers with a base (Auwers & Auffenburg, 1919). The mechanism of the formation of the ethers can best be explained on the basis of the hydrolysis of the bromo coumpound to the hydroxy-derivative, followed by a Williamson synthesis :



The 2, 2-di halo-coumaranones readily undergo hydrolysis to coumaran 2, 3-di one, with the result that most of the reactions of the dihalogen derivatives are identical with those of the diones. Thus di-halo-coumaranone with o-phenylene diamine yields the quinoxaline :



Coumaranone derivatives with halogen atoms in the benzene ring are also known. These are prepared, according to the general

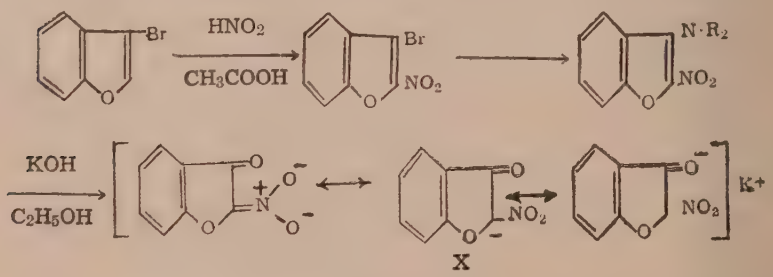
methods, starting with the corresponding halogenated phenoxy acetic acids or halogenated—w-chloro acetophenones.

In the preparation of 5-chloro-coumaranone by the three general methods, viz, (1) by cyclization of the acid chloride of phenoxy acetic acids with $AlCl_3$, (2) by cyclization of 2-hydroxy—w-chloro acetophenones with dilute alkali and (3) by cyclo-dehydration of phenoxy acetic acid in benzene with P_2O_5, the compound resulted only in traces by methods (1) and (3) and in fair yields by (2). But the 5, 7-di-chloro derivative of coumaranone could not be prepared by any of the three methods. (Kalinowski & Kalinowski, 1948).

These halogenated coumaranones in general possess all the properties of the parent compound, but their halogen atoms are not so active as those in the 2-position for obvious reasons.

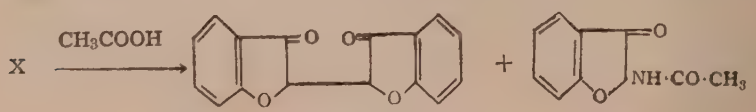
(E) 2-Nitro-Coumaranones

2-nitro-coumaranone is prepared starting with the bromo-derivative of coumaranone by the following reactions:



X

The substance is stable only as the salt, X. With water it is immediately converted into oxindigo, but when treated with acetic acid, the compound XII, together with oxindigo is formed.

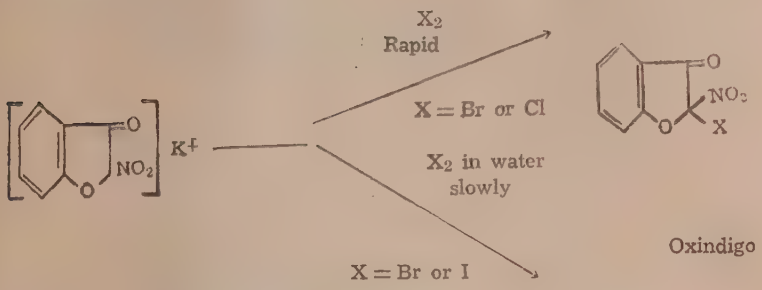


XI
Oxindigo

XII

When the nitro-compound is brominated or chlorinated rapidly in water or benzene solution, the 2-halogen-compounds are formed. But, when bromination or iodination is done slowly in aqueous

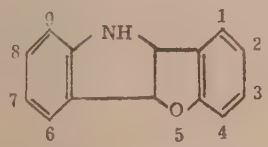
solution, so that the halogen can act as an oxidising agent, oxindigo is formed :



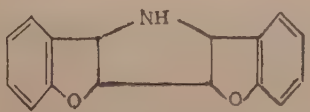
(F) Formation of Indoles and Azines

(Cornforth, Hughes, Lions & Harrdence, 1938)

Various aryl hydrazones of coumaranone are cyclized to the corresponding coumarano—(3, 2f)—indoles with great ease. Thus heating coumaranone with phenyl hydrazine on the water-bath, followed by dissolving the resulting phenyl hydrazone in excess of acetic acid and boiling for a few minutes results in the formation of coumarano—(3, 2f)—indole, m. 198°.



In a similar manner, using hydrazine sulphate, the coumarano-azines can be prepared. For example, hydrazine sulphate, sodium acetate in water and coumaranone when heated under reflux give coumaranone-azine, m. 207-8°. This compound resists hydrolysis by methyl-alcoholic-KOH, but is hydrolysed when boiled with strong aqueous HCl. It is readily converted, by boiling with acetic acid into di-coumarano-pyrrole, m. 330°.



(6) Characterisation of Coumaranones

Generally the coumaranones are identified by their reactions with ketonic reagents like hydroxylamine, phenyl hydrazines, and

semi-carbazide. The 2, 4-di-nitro-phenyl hydrazones and the oximes are very commonly crystalline compounds with sharp melting points. Sometimes the ultra-violet spectrum is of value to distinguish the coumaranones from other similar compounds.

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SCALE STUDY OF *MUGIL CEPHALUS*, LINNAEUS OF CHILKA LAKE

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Introduction

In recent times, the scales of fishes are being studied with a view to find out the age and growth, to be compared with other biological data available for their determination. Scales of Indian mullets especially *Mugil cephalus* have not been studied from this point of view. Mookerjee (1948) has made a study of the structure, form and development of scales in *Mugil* species. Pillay (1951) has described the structure and development of the scales of five species of mullets occuring in Bengal and has provided a key for their identification through the scale characters. Jacot (1920) has given the structure of the scale of *Mugil cephalus*, Linnaeus and has shown the possibility of 'linea' representing the annulus and has also given the approximate growth rates and the span of life. Kesteven (1942) has also given a brief description of the scales of *Mugil dobula*, Gunther, which is a closely allied species to *Mugil cephalus*, Linnaeus and has carried the work on scales further to establish beyond dispute certain conclusions regarding the age and growth of the species. Seshappa and Bhimachar (1951) have recently suggested in their review on the age determination studies in various fishes of the tropical waters that while the fishes of the temperate countries present a well marked zonation, those of the tropical fishes seem to lack such distinct markings. The present work on the scales of *Mugil cephalus*, in addition to confirming the views of the last mentioned authors, throws further light on the biology of the species in relation to its growth and life history in the Chilka Lake.

Material and methods

127 fishes ranging from 120 to 650 mm. have been taken up for this study. Four scales were removed from each fish from the row just above the lateral line near about the place touched

by the tip of the pectoral fin since the scales on the lateral line are marked by sensory grooves which prevent clear reading of of the scales. Further, the scales of the pectoral area are comparatively clearer than the scales of the other regions due to the constant rubbing of the fin. The scales were mounted dry between two glass slides as this method was found to give satisfactory results. No projector could, however, be used to study the scales; instead, ordinary dissecting microscope was used to make detailed study.

The length of the scales was taken from the anterior to the posterior end while under the microscope so that the length could be measured with accuracy. Radial measurement as recommended by some workers was impossible due to lack of projecting equipments.

The structure of the scales of Mugil cephalus (Fig. 1-3)

The scale is ctenoid with fairly straight dorsal and ventral borders and a rounded posterior border; the anterior border,

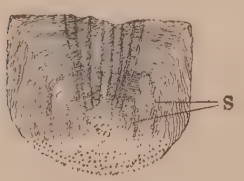

Fig. 1

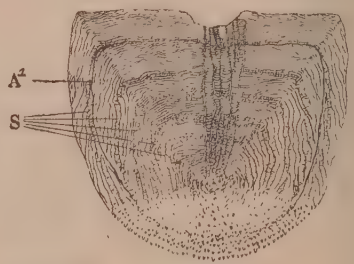

Fig. 2

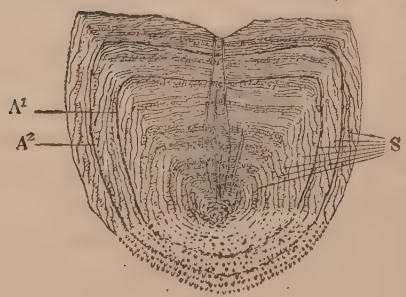

Fig. 3

FIG. 1. The scale of 175 mm. long specimen of *M. cephalus*. × 10
FIG. 2. The scale of 400 mm. long specimen of *M. cephalus*. × 6
FIG. 3. The scale of 490 mm. long specimen of *M. cephalus*. × 5.

(A—Annulus; S—Sculptured marks).

though straight, invariably has one or two depressions in the middle. The rounded border may be ornamented with ctenı or smooth. Mostly the scales are regular and distorted scales are rare.

The entire scale may be divided into four sectors, two lateral, one anterior and one posterior. The first three are in the form of distinct triangles, their apices directed towards the centre ; the posterior sector is in the form of a segment whose base passes right through the nucleus. The nucleus itself is devoid of any lines and appears as a clear spot, though under the microscope it can be found to be made up of irregularly placed granules.

Round the nucleus, except at the anterior side, the granules seem to extend in the form of ridges called circuli. The ridges in the anterior sector are roughly double in number those of the lateral sectors and each is only half as wide as those of the lateral sectors. The circuli are fairly regularly placed and do not vary greately in width except near the nucleus and the anterior edges The extra circuli at the anterior sector fail to continue in the lateral sectors. In the lateral sectors too there are incomplete circuli traversing only part of the sector.

Kesteven (Op. cit.) remarks "There is no differentiation of scales into 'winter' zones of narrow circuli and 'summer' zones of broader ones ; but 'breaks' occur in the regular disposition of the circuli." Though there are 'breaks' at the lines of demarcation between the three triangular sectors, which are responsible for giving a semblance of distinct triangles, only those that occur with intensity along the circuli at definite intervals are supposed to be caused by the irregularity in growth during the winter months or the non-feeding period. Jacot (Op. cit.) distinguishes the 'line' or 'break' (1) laterally by the termination of the circuli in exactly the same way as they are terminated at the outer edge of the scale, and (2) anteriorly by the termination of the circuli in exactly the same way as they terminate at the anterior edge of the scale. The author could come across 'lines' of Jacot's description carrying all the details in only two of the whole collection of fishes. To the naked eye and under the magnifying lens, the circuli having repeated 'breaks' appear as bright lines but under the microscope no such lines are visible except the 'breaks' and the congested appearance of the circuli having comparatively less interspace between them. Evidence for

the interpretation of these 'breaks' as denoting arrested growth due to certain external and internal causes, is usually assumed by comparing the occurrence of 'breaks' with the growth rate of the fish obtained through Peterson's method (Kesteven, 1942 and Walford, 1932). However, taking for granted that these 'breaks' represent certain events in the life of the fish at certain intervals, we shall examine in detail the feasibility or otherwise of this interpretation in the light of the present study.

The fundamental principle underlying the interpretation of annulus being the retardation of growth in winter when the fish is supposed to go without feeding, it is but natural to consider the relationship between the growth of the fish and the severity and duration of the winter season in the lake.

The surface temperature of Chilka water during the winter ranges from 25°C to 26·6°C whereas the maximum temperature recorded in summer is only 33°C. The difference in temperature being 7 to 8 degrees, it is very unlikely that the fish will be so much affected asto prevent it from feeding. The theory of annulus has its origin in the countries like America which are in the temperate zone having a minimum surface temperature of 4°C to 11·7°C in the winter and a maximum of 23°C to 25·1°C in summer (Doudoroff, 1942, Clarke, 1940). As a consequence of such low temperature, the fishes are prone to cease feeding and a state of inactivity may ensue. This extreme condition does not occur in the tropical areas in which Chilka Lake is situated and the application of the theory to tropical fishes will be out of place.

Even assuming that winter does affect the growth of fish in Chilka and its effect is manifested on the scales in the form of annulus, annulus must be present in all the scales without exception, more or less in intensity. The present study which was fairly thorough in details, does not show that the above is the case. In the same fish, one scale carries the mark of annulus whereas some other does not. Neither are the number and position of annuli the same in all the scales of the same fish. Much depends on the assumption of the annuli which have no difference with many other marks on the scale. That individual discretion plays a more predominant and decisive part than scientific reasoning is proved by the fact that the readings of the same scales by two different workers never tally and the percentages of agreement vary from 66 per cent (Walford, 1932) to 94 per cent (Walford and Mosher, 1943). Much of the difficulty is caused

by the presence of several 'false' annuli which are incomplete or appear complete by the coincidence of occurance of two 'false' annuli along the same circuli. 'False' rings in *Mugil dobula* have been attributed to several causes by Kesteven (Op. cit.) among which the inability of the fish to accomplish migration due to natural and artificial obstructions, and migrations to the sea where the fish generally starves due to its bottom feeding habits in the shallow inshore waters, are considered important. He further states that it is possible to find a 'break' in one sector or shoulder and not in others and to find two or more 'breaks' close together and that the decision upon these relates to a matter of interpretation of the scale phenomena. About *Mugil cephalus*, Jacot (Op. cit.) writes "the actual number of 'lineae' cannot be absolutely relied upon for the age of the individual. Further, one cannot consider every 'linea' a migration line as any cessation in feeding or growth for any reason whatever, might cause the interruption and renewed growth of the scale necessary to form a 'linea'. Therefore, though the actual number of 'linea' is not always reliable for the determination of the number of seasons which the individual has passed through, the 'linea' may be relied upon for age determination when properly understood."

Mugil cephalus has been found to breed between September and January in the sea (Devasundaram, unpublished) and hence the larvae hatched out during the winter must be as much subject to winter condition as the older fish. If the older fish is affected to the extent of making it suspend its feeding habits, the newly hatched larvae can hardly survive the winter. But the fact remains that the young larva lives through the winter and enters the lake by summer i.e., April to June and continues to replenish the lost stock. Even if the formation of annulus were to be an unquestionable phenomenon, winter can never be the cause for its formation in the tropical fishes.

In case circuli formation is taken as a continuous phenomenon closely related to the growth of the fish, the innumerable 'breaks' that occur in between the three triangular sectors are inexplainable. 'Breaks' occur all along the breadth of the scale in the circuli, seemingly unconnected with any regular phenomenon.

Circuli between the nucleus and the anterior border of the scale are mostly uniform in width but variation in width is not

uncommon in certain scales. The portions where such dissimilar circuli occur reflect, when examined under the lens, as annuli do and there is every likelihood of their being mistaken for annuli.

Workers on scales of mullets seem to have failed to notice another characteristic phenomenon which goes to make the confusion of determining the annuli worse confounded. The scales of fishes measuring upto 174 mm. do not show any marking except a few irregularities in the width of circuli giving it a deceptive appearance of annuli. From 175 mm. onwards fishes show certain sculptured marks which are at first placed at right angles to the circuli cutting across two or three circuli but conforming to them. These sculptured lines appear under the lens as white opaque lines which are more prominant than the actual annuli. They are more pronounced on the lateral sides than on the anterior part of the scale. There is a tendency for these lines to be broad towards the centre than towards the sides. The number of these marks increases as the scale increases in size. The maximum of these clear marks recorded is 12 in a fish measuring 490 mm. in total length. As the number of marks increases, the older marks near the nucleus get over-imposed by several other sculptural marks which may be at different angles and even parallel to the circuli. Even the interspace between the two previously distinct lines get obliterated so that the entire portion appears like an area infested with irregular sculptured marks. The number of these marks, though apparently increases arithmetically to the increment of the scale size, varies in numbers in different scales of the same fish. Some of the scales do not posses these marks at all, thereby proving that these marks are not connected in any way with either the periodical growth of fish or its retardation in growth.

The foregoing facts tend to prove that neither the conventional 'breaks' nor the differential growth of circuli in thickness nor the sculptured lines can be safely assumed as representing year marks. Even when equal number of rings or lines are formed, they are not at uniform distance from the centre which is a very strong point to show that these rings or lines may not after all be yearly phenomena occuring at uniform periods in all the scales. The casual occurrence of these structural features does not seem to convey any definite meaning except that it occurs due to certain internal and external disturbances which need not necessarily pertain to winter conditions or non-

feeding habits alone. In this connection it is worthwhile reiterating the views of Sheshappa and Bhimachar (Op. cit.) that while the scales of fishes in temperate countries present a well marked 'summer and winter' zonation, those of the tropical fishes seem to lack such distinct markings.

Age Determination Through Scales

Despite the innumerable difficulties *Mugil* scales present in determination of age, an attempt was made to determine the number of annuli in the scales to be compared with results obtained through Peterson's method. In distinguishing the annuli, Jacot's definitions were followed as far as practicable. Table I contains all the scales studied giving the total length of fish and the number of annuli.

From the findings it is surmisable that the first annulus makes its undoubtable appearance by about 300 mm. stage though from 230 to 300 mm. length there are stray cases of annulus occuring in few of the scales. It is of importance that the annulus does not appear in all the scales of the same fish nor in all the fishes of the same length. However, in as much as there is fairly regular occurrence of annulus in the fishes measuring from 300 to 420 mm., we may be justified in fixing 300 mm. as the length in which the fish has completed its first anniversary of its life within which it has passed through the physiological changes conducive to the formation of the first annulus.

The second ring is detected after the fish has grown to 420 mm. in total length. The range of total length for the occurance of II year ring is 420 to 550 mm. Within that range, however, all the scales do not show two rings uniformly; there are single rings in some and one scale has even three rings. Since the majority show two rings the range has been taken to represent the II year old fish.

Only two fishes measuring 570 mm. and 650 mm. showing three year rings have been obtained in the course of the present study. As the very maximum size of the fish recorded in the lake is 650 mm. it may be safely presumed that the range 570 to 650 mm. represents the III year old fish procurable in the lake.

The above findings, when compared with the results obtained through Peterson's length frequency method (Devasundaram Op. cit.) indicate certain discrepancies. The I year fish, according to

length frequency studies, grows 23 mm. per month covering a total length of 276 mm. whereas according to the scale studies, the I year fish show a growth up to 300 mm. i.e., a growth rate of 25 mm. per month.

The II year fish i.e., the fish with one annulus grows as shown by the length frequency studies, upto 516 mm. at 20 mm. per month, whereas the scale studies show a growth upto 420 mm. at 10 mm. per month.

The III year fish i.e., the fish with two annuli has a growth rate of 6 mm. per month according to length frequency findings and the fish grows upto 546 mm., whereas the scale studies give a growth upto 550 mm. at 10·1 mm. per month.

The IV year fish i.e., the fish with three annuli is absent as found from length frequency studies since at the end of the III year the female fish has been found to migrate to the sea quitting the lake for ever, the male fish having quitted it by the end of II year. The scale studies show the IV year fish with three annuli of a little doubtful character but the growth in the IV year is upto 650 mm. i.e., 8 mm. per month.

It is very clear from the above facts that whereas according to deductions from length frequency studies the fish has a life span of three years in the lake, as deduced from the scale studies the fish could be taken as spending four years in the lake. The following is the comparative table showing the growth rate deduced from the two methods:

Age.	Peterson's method growth rate p.m.	Scale method growth rate p.m.
I Year	23 mm.	25 mm.
II Year	20 mm.	10 mm.
III Year	6 mm.	10·1 mm.
IV Year	—	8 mm.

In view of the doubtful nature of the decipherment of the annuli on the scales, the author places more reliance on Peterson's method than on the scale method. Further, the data available for the determination of age and growth rate through Peterson's method were far more enormous and continuous than that available for the scale study.

Comparing the above results with those obtained by Kesteven (Op. cit.) in the scale studies, a great disparity could

be noticed regarding the age and growth. The growth of *Mugil dobula*, Gunther, which is a closely allied species to *Mugil cephalus*, Linnaeus, is about 150, 230, 320, 400 and 480 mm. in the first five years having a growth rate of about 10·2, 7, 8, 7 and 7 mm. per month. He has found that the span of life for the fish is six years and a few months. Though he based his conclusions on voluminous data, they seem to have little bearing on its kindred species in the lake Chilka.

Jacot (Op. cit.) in his observations on *Mugil cephalus* of the Atlantic coast does not clearly state the growth rate nor the range of the different year groups. However, he states that the fish spawns for the first time in its second year. From the data he has given it may be deduced that the I year fish ranges in length upto 120 mm., the II year fish from 121 to 431 mm. and the III year fish from 439 to 493 mm. The largest mullet he has recorded shows from its scales that it must belong to the V year class. These observations, though partly coincide with the present observations in the fact that the males ripen at the end of the II year, do not seem to provide a correct statement of facts regarding the growth and span of life of *Mugil cephalus*.

Scale Length — Total Length Relationship

340 scales varying in length from 4 to 16 mm. taken from 92 fishes with a length range of 120 to 570 mm. were utilized for the study. All the scales in a fish were not of uniform sizes but varied to a slight extent. The Seriation Correlation Table Method was used to find out the correlation co-efficient. The raw data were arranged into 10 classes with a class interval of 1·8 mm. in the case of scale length and 54 mm. in the case of total length. These class ranges of both characters along with the frequency falling under each class, were filled in the usual correlation table. The necessary calculations were then made. The key calculations leading to the derivation of the formula of the regression lines are given below.

x	Scale length	y	Total length
$\bar{x}$	7·63	$\bar{y}$	270·7
ó$_x$	3·186	ó$_y$	111·24

r	0·97
bxy	0·028
byx	33·86
S.E.	0·0031

(where $\bar{x}$ and $\bar{y}$ are means of measurements of the characters x and y, óx and óy are standard deviations of the respective characters, r is the co-efficient of correlation, bxy is the regression of x axis over y and byx is the regression of y axis over x and S.E. is the standard error of estimate).

Equation of the regression line :

Total length $= 12 \cdot 3 + 33 \cdot 9$ Scale length.

Table II shows the relationship between the scale length, the average total length and the calculated total length, with the sexes and all ages combined. This general combination of data was made only after a detailed examination of the scale length — total length relationship of juvenile, male and female fishes failed to reveal any remarkable differences separately.

A comparison of the regression line for the above equation with the averages of the empirical data may be had from figure 4.

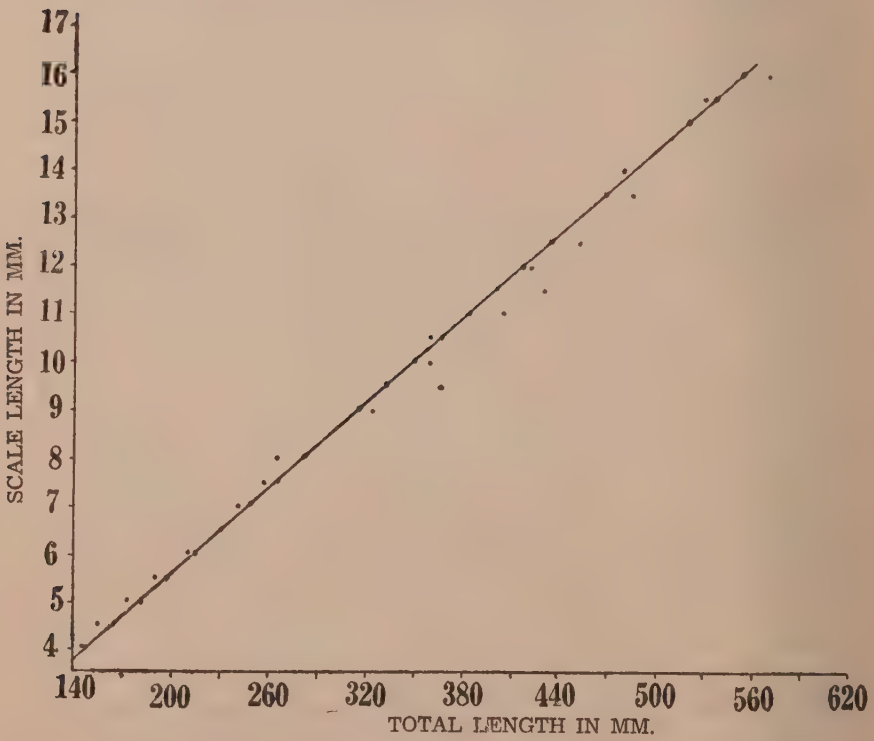

Fig. 4. showing the regression line of Scale length—Total length relationship. Scattered dots indicate the avg. total lengths plotted against scale lengths.

It may be seen that the theoretical curve fits the empirical data rather closely.

Since the parabolic equation describes satisfactorily the total length — scale length relationship of *Mugil cephalus* of Chilka lake, it may be stated for these populations that:

1. The growth of the scale with increase in the length of the fish proceeds along a line whose backward continuation will pass through 0, 12;
2. The relative rates of growth of body and scale maintain a constant ratio.

Summary

1. 'Breaks' or 'Lines' are not regular phenomena but perhaps occur due to some physiological causes other than those enumerated by the previous authors.
2. Winter cannot affect the fish of the tropical waters to that extent as to make it stop feeding and thereby cause disturbance in the growth of fish in general and the scales in particular.
3. Sculptured marks on scales have been described for the first time. They add to the confusion when determining the age.
4. The scale study shows that the life-span of the fish in the lake is 3 years and a few months whereas other biological data available tend to show that the fish quits the lake by the end of III year of its stay in the lake.
5. The growth rate according to the scale method is 25, 10, 10·1 and 8 mm. per month for four years where according to Peterson's method it is 23, 20, and 6 mm. per month for 3 years. They do not tally with the findings of Kesteven for *Mugil dobula*.
6. The total length — scale length relationship shows a correlation co-efficient of ·97. The equation of the regression line is:
   Total length = 12·3 + 33·9 Scale length.
7. The relative growth of body and scale maintains a constant ratio.

Table I showing the number of annuli in four scales of each fish studied.

Ser. No.	Total Length of fish in mm.	No. of annuli.			
1.	120	..	..	..	..
2.	140	..	..	..	..
3.	145	..	..	..	..
4.	145	..	..	..	..
5.	150	..	..	..	..
6.	150	..	..	..	..
7.	155	..	..	..	..
8.	160	..	..	..	..
9.	160	..	..	..	..
10.	160	..	..	..	..
11.	164	..	..	..	..
12.	165	..	..	..	..
13.	165	..	..	..	..
14.	168	..	..	..	..
15.	170	..	..	..	..
16.	175	..	..	..	..
17.	175	..	..	..	..
18.	175	..	..	..	..
19.	178	..	..	..	..
20.	180	..	..	..	..
21.	180	..	..	..	..
22.	190	..	..	..	..
23.	195	..	..	..	..
24.	195	..	..	..	..
25.	200	..	..	..	..
26.	205	..	..	..	..
27.	210	..	..	..	..
28.	210	..	..	..	..
29.	210	..	..	..	..
30.	210	..	..	..	..
31.	210	..	..	..	..
32.	215	..	..	..	..
33.	215	..	..	..	..
34.	215	..	..	..	..
35.	215	..	..	..	..
36.	220	..	..	..	..
37.	220	..	..	..	..
38.	220	..	..	..	..
39.	220	..	..	..	..
40.	225	..	..	..	..
41.	230	1	1	..	..
42.	230	..	..	..	..

Ser. No.	Total Length of fish in mm.	No. of annuli.			
43.	230	..	..	..	..
44.	230	..	..	..	..
45.	230	..	..	..	..
46.	233	..	..	..	..
47.	233	..	..	..	..
48.	235	..	1	..	..
49.	235	..	..	..	..
50.	235	1	..	..	..
51.	235	..	..	..	..
52.	240	..	..	..	..
53.	240	..	..	..	..
54.	240	..	..	..	..
55.	240	..	..	..	..
56.	245	..	..	..	..
57.	248	..	..	..	..
58.	248	..	..	..	..
59.	250	..	..	..	..
60.	250	..	..	..	..
61.	250	..	..	..	..
62.	250	1	1	..	1
63.	250	..	..	..	..
64.	250	..	..	..	..
65.	255	..	..	..	..
66.	255	..	..	..	..
67.	255	..	..	..	..
68.	260	..	1	..	1
69.	260	..	..	..	..
70.	260	..	..	..	..
71.	260	..	..	..	..
72.	265	..	..	..	..
73.	265	..	..	..	..
74.	265	..	..	..	..
75.	270	..	..	..	..
76.	270	1	1	1	..
77.	275	..	..	..	..
78.	275	..	..	1	1
79.	280	..	..	..	..
80.	280	..	..	..	..
81.	280	..	..	..	..
82.	280	..	..	..	..
83.	280	..	..	..	..
84.	280	..	..	..	..
85.	285	..	..	..	..
86.	285	..	..	..	..

Ser. No.	Total Length of fish in mm.	No. of annuli.			
87.	290	..	..	..	..
88.	290	..	..	..	..
89.	290	..	..	..	..
90.	300	1	1	..	1
91.	310	..	..	1	..
92.	310	..	..	..	..
93.	310	1	..	..	..
94.	315	1	..	1	..
95.	320	..	..	..	..
96.	330	1	1	..	1
97.	340	1	1	..	..
98.	350	..	..	..	..
99.	350	1	1	1	..
100.	355	1	1	1	1
101.	360	1	1	1	..
102.	360	..	..	..	..
103.	360	..	1	..	..
104.	360	..	..	..	..
105.	365	1	1	1	..
106.	366	..	1	..	..
107.	400	1	1	1	..
108.	400	..	..	..	..
109.	405	..	..	1	..
110.	405	..	..	..	..
111.	420	1	1	1	..
112.	420	2	2	2	2
113.	420	1	1	1	..
114.	425	2	..	2	2
115.	430	2	2	2	..
116.	433	1	2	1	2
117.	435	2	2	2	2
118.	440	2	2	1	2
119.	480	3	1	1	..
120.	485	2	2	2	2
121.	490	2	2	2	2
122.	495	..	1	1	2
123.	530	2	2	2	2
124.	540	2	2	2	2
125.	550	2	2	..	1
126.	570	3	3	3	3
127.	650	3	3	3	3

Table II showing the Scale length — Total length relationship of *Mugil cephalus*.

Scale length in mm.	No. of scales.	Average Tot. len. in mm.	Cal. Tot. len. in mm.
4	12	145	148
4·5	18	155	164
5	43	173	181
5·5	15	190	198
6	43	211	215
6·5	34	230	232
7	63	241	249
7·5	17	257	266
8	12	265	283
9	7	327	317
9·5	4	366	334
10	8	360	351
10·5	4	360	368
11	3	405	385
11·5	7	431	402
12	16	420	419
12·5	12	452	436
13·5	4	485	469
14	4	480	486
15	6	520	520
15·5	4	530	537
16	4	570	554
	340		

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